United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with the Research Division of the College of Agricultural and Life Sciences, University of Wisconsin

Soil Survey of Lincoln County, Wisconsin

How To Use This Soil Survey

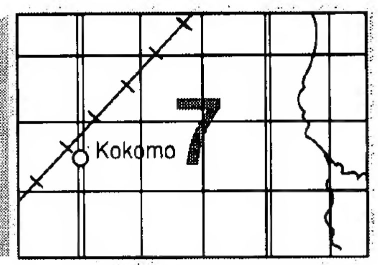
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

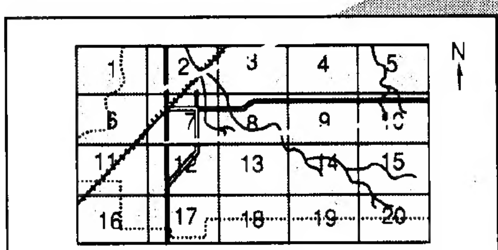
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



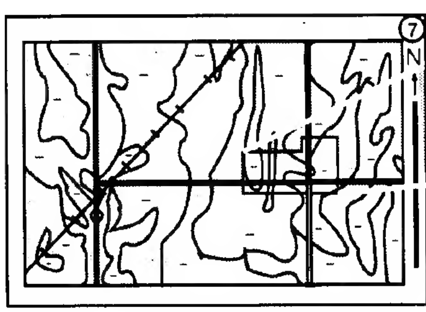
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



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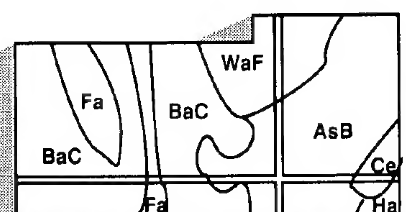

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1991. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1993. This survey was made cooperatively by the Natural Resources Conservation Service and the Research Division of the College of Agricultural and Life Sciences, University of Wisconsin. It is part of the technical assistance furnished to the Lincoln County Land Conservation Committee, which helped finance the fieldwork.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Natural Resources Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Tahoe Lake in the Harrison Hills area. Lincoln County has many scenic lakes.

Contents

Issued November 1996

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Lincoln County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Patricia S. Leavenworth
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Soil Survey of
Lincoln County, Wisconsin

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United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with
the Research Division of the College of Agricultural and Life Sciences, University of Wisconsin

LINCOLN COUNTY is in the north-central part of Wisconsin (fig. 1). It has a total area of 581,261 acres, of which 14,125 acres is water. In 1987, the county had a population of 26,803. The population increased by 14 percent from 1970 to 1987. The major cities are Merrill, the county seat, and Tomahawk. In 1987, the population was 10,008 in Merrill and 3,505 in Tomahawk.

Manufacturing, agriculture, lumbering, tourism, and recreational enterprises provide Lincoln County with a diversified economic base. Manufacturing employs the most people, largely in wood-using industries. Dairying is the major farming activity. It is based mostly in the south-central area, around Merrill, and along State Highway 17 in the eastern part of the county. Lumbering enterprises are based on the large area of timber resources. The western part of the county consists mostly of forest land. In 1983, about 70 percent of the county was classified as forest land, including many areas that are publicly owned. The wooded areas and the many wetlands, lakes, and streams provide opportunities for tourism and recreational enterprises. The strong retail trade reflects purchases by tourists and other vacationers.

A reconnaissance soil survey of Lincoln County was made prior to 1918 by the Soil Survey Division, Wisconsin Geological and Natural History Survey, State of Wisconsin, in cooperation with the United States Department of Agriculture, Bureau of Soils. This reconnaissance soil survey is part of a report published in 1918 (Whitson and others, 1918). The present survey updates the 1918 survey, provides more interpretive information, and has larger maps, which show the soils in greater detail.

General Nature of the County

This section provides general information about the county. It describes climate; physiography, relief, and drainage; water supply; history and settlement; forestry and lumbering; farming; and transportation facilities and industry.

Climate

Winters in Lincoln County are very cold, and summers are short and fairly warm. The short frost-free period in summer limits the production of crops to forage, small grain, and adapted vegetables. Precipitation is fairly well distributed throughout the year. It reaches a peak in summer. Snow covers the ground during much of the period from late fall through early spring.

The soils occasionally freeze to a depth of several feet when very cold temperatures occur before the ground is appreciably covered with snow. Unless the

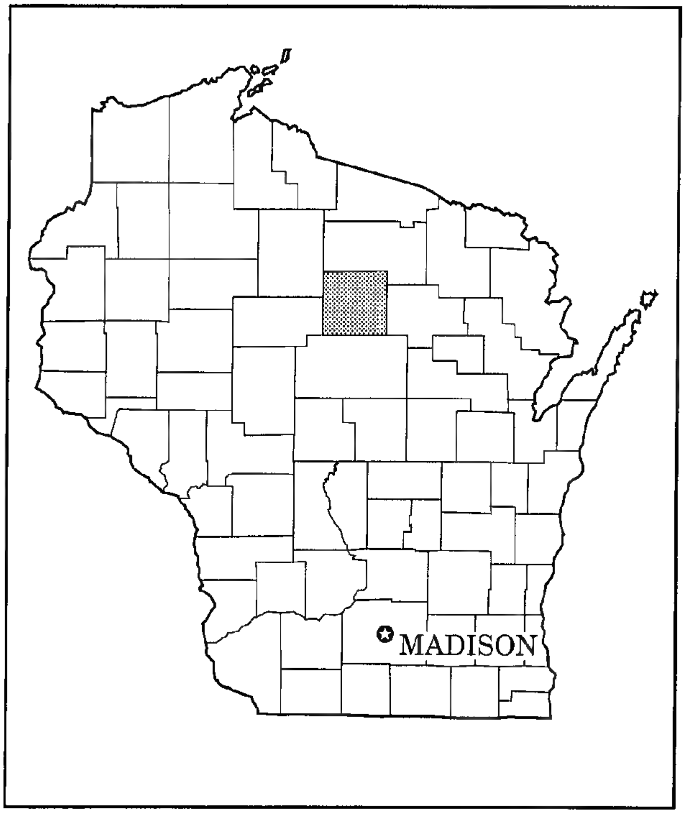

Figure 1.—Location of Lincoln County in Wisconsin.

snow cover is removed, the soils usually freeze to a depth that ranges from the top few inches to about 1 foot.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Merrill, Wisconsin, in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 15 degrees F and the average daily minimum temperature is 4 degrees. The lowest temperature on record, which occurred at Merrill on January 9, 1977, is -39 degrees. In summer, the average temperature is 66 degrees and the average daily maximum temperature is 79 degrees. The highest recorded temperature, which occurred on July 26, 1955, is 98 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 31.41 inches. Of this, 22 inches, or 70 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 3.74 inches at Merrill on August 24, 1962. Thunderstorms occur on about 34 days each year.

The average seasonal snowfall is 42 inches. The greatest snow depth at any one time during the period of record was 30 inches. On the average, 68 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Physiography, Relief, and Drainage

Lincoln County is in the Northern Highland physiographic region of Wisconsin. This region has some of the highest elevations in the state. Elevations range from about 1,910 feet above sea level, on a hill bordering the east side of Ament Lake in the northeastern part of the county, to about 1,220 feet at the point where the Wisconsin River leaves the county. Merrill is about 1,300 feet above sea level, and Tomahawk is about 1,450 feet.

The physiography, relief, and drainage of Lincoln County are primarily the result of glaciation. They are modified by ridges of hard bedrock in the southern part of the county. The landscape is very diverse. Moraines, eskers, kames, ice-contact lake basins, and drift-mantled ridges and hills of bedrock are generally in the highest positions on the landscape. These landforms are interspersed with lower areas of outwash plains, drumlins, lake plains, and bogs and other depressional areas where organic soils have formed.

The most prominent physiographic feature is the broad belt of dominantly end moraine that extends across the county from the northeastern part to the south-central part and then through the west-central area. This end moraine area has the highest elevations and the roughest terrain in the county.

The end moraine area has a complex physiography, especially in the central and northeastern parts of the

county. Some parts of the landscape, such as the Harrison Hills and the Underdown Hills, are typical morainic hills and ridges interspersed with many bogs, swamps, ponds, and lakes in kettles that resulted from the melting of buried ice blocks. Most of the kettles have no outlet. Slopes are short and complex in these areas. Other parts of the landscape, such as the Nine Mile, Irma, and Chase Hills, are distinct ridges or hills of bedrock that are covered by glacial drift. These bedrock areas commonly do not have wet depressions. The hills and ridges of end moraine in the central and western parts of the county are intermingled with small, relatively flat ice-contact glacial lake basins of lacustrine deposits. The sediments forming these basins were deposited in water-filled holes in the surface of glacial ice and now occupy some of the highest positions on the landscape. They are bordered by prominent ridges of glacial drift. In the central and northeastern parts of the end moraine landscape, the melting and readvances of glacial ice created recessional moraines and some initial landscape formations were subsequently destroyed or buried by outwash deposits from the melting ice. As a result, the terrain is characterized by small, rather flat outwash plains interspersed with swells, hills, and ridges of outwash and glacial till. On this landscape, slopes vary from nearly level and smooth to very steep and complex within short horizontal distances.

The landscape in the southern part of the county has only a few lakes and undrained depressions. It is an area of older glaciation where relatively flat outwash plains are in the major river valleys, such as the Prairie River valley. The valleys meander through broad swells of morainic upland where bedrock is close to the surface. In this area, slopes are generally long and smooth. Local relief commonly is about 100 feet.

A large outwash plain with low relief dominates the north-central part of the county. The topography is mostly flat, except for a few morainic mounds that protrude slightly higher than the level of the plain. Depressional areas, such as drainageways and basins, are common throughout the outwash plain. Streams, lakes, swamps, bogs, and marshes are in these lower areas.

An area of elongated drumlins and low recessional moraines segmented by drainage valleys of bogs and swamps is in the northwestern part of the county. The drumlins were shaped in grooves at the base of ice lobes and are oriented parallel to the movement of the ice sheets. In this area, the melting glacial ice retreated to the northwest and the landscape features are oriented southeast to northwest. The area has little local relief because glacial meltwater filled the low areas with outwash. Many of the drumlins and moraines also are veneered with outwash. Slopes are mostly long and smooth.

Lincoln County is entirely within the drainage basin of the Wisconsin River, which enters the northeastern part of the county, flows southwest to Tomahawk, and then flows south to generally bisect the county from north to south. The 285-foot drop of the Wisconsin River in the county is moderated by six water-control structures (fig. 2). Four principal tributaries of this river drain the eastern part of the county. They are the Pine River, the Prairie River, Little Pine Creek, and Big Pine Creek. The Tomahawk, Somo, Spirit, New Wood, and Copper Rivers are the main tributaries on the west side of the Wisconsin River.

Generally, the surface-water drainage system is well developed only in the area of older glaciation in the southern part of the county. In this area, runoff moves rapidly to flowing streams. Bogs, swamps, and marshes abound in other areas of the county where natural drainage systems are not well established. In those areas, the many kettles, basins, and other depressional areas tend to accumulate and hold runoff. They are an important part of the natural reservoir system, which helps to regulate the flow of rivers and to minimize flooding.

Water Supply

Lincoln County has an abundant supply of water to meet present and anticipated needs for domestic, agricultural, municipal, and industrial uses. Sources are the 14,125 acres of surface water and the ground water, which is primarily from glacial deposits.

More than 700 lakes and impoundments in the county make up most of the acreage of surface water. The construction of six water-control structures across the Wisconsin River has significantly increased the amount of surface water in the county. These structures also help to control flooding.

Most of the lakes are seepage lakes. The others are spring lakes, drainage lakes, or drained lakes (Carlson and Andrews, 1982). The majority of the lakes, including most of the spring lakes, also known as spring ponds, are small. Only 23 lakes are 100 acres or larger, but these make up 73 percent of the surface area of lakes. Deer Lake is the largest spring lake. Pesabic Lake and the other seepage lakes are landlocked (fig. 3). Lake Mohawksin, an impoundment and a drainage lake, is the largest body of water in the county. The deepest lake is Hilts Lake, which is as much as 70 feet deep.

Lincoln County is drained by more than 230 streams with a total surface area of about 2,600 acres and a total length of about 670 miles. The largest of these

Figure 2.—Grandfather Dam, in an area of Magroc soils. The flow of the Wisconsin River is moderated by six such water-control structures in Lincoln County.

streams is the Wisconsin River, which has a surface area of about 1,380 acres.

The surface water in the county is used mostly for recreational activities and watering stock. Four impoundments on the Wisconsin River, however, are used primarily for generating electricity. Industrial and municipal wastewater is discharged into this river at Merrill and Tomahawk.

The quality of the surface water is generally good, except for the Wisconsin River and associated impoundments, where industrial wastes have impaired the water quality. The northern and western parts of Lincoln County have good-quality surface water because the watersheds are mostly in areas of woodland (fig. 4). Eutrophication is a problem in the agricultural area in the southern part of the county, where excessive runoff carries nutrients to the lakes and streams. During the summer, the shallow water areas contain algae and weeds.

The surface water is mostly clear or light brown and has good light penetration for biological productivity. The landlocked or seepage lakes bordered by bogs are more acid than the other water areas. The spring lakes have the highest pH value. The water is predominantly soft in the seepage lakes, drained lakes, and drainage lakes, but it is generally hard in the spring lakes. Biological productivity is highest in the streams and spring lakes.

The ground water in the county meets municipal, industrial, and rural needs. Well water is available at various depths, depending on the general topography, the distance above permanent stream levels, and the character of the underlying aquifer. The well water is stored in porous strata called aquifers. At certain depths below the surface, all pores and fissures in unconsolidated material, such as sand and gravel, are filled with water. Wells drilled into these layers yield an adequate water supply. The level of ground water rises or falls from season to season and year to year, depending on the amount of rainfall. Seasonally, the

level generally rises in spring, declines in summer, rises slightly in fall, and declines in winter.

Most ground water in Lincoln County is obtained from sand and gravel aquifers. These aquifers occur as surficial sand and gravel deposits or as isolated buried deposits in the moraine areas.

The surficial sand and gravel deposits are mainly on extensive outwash plains. They are highly permeable and yield large quantities of water to wells. Most high-capacity wells are 40 to 140 feet deep. They usually yield 15 to 60 gallons per minute per foot of drawdown. Generally, the glacial till in moraine areas yields less than the outwash deposits. Yields also are lower in areas where till is intermixed with the sand and gravel. The underlying crystalline bedrock, which is close to the surface in the southern part of the county, yields little or no water. Shallow wells in the areas of surficial outwash are subject to pollution.

The quality of the ground water in Lincoln County is good. Local differences in quality are the result of the composition, solubility, and surface area of the soil and rock through which the water moves and the length of time that the water is in contact with these materials. Generally, the content of dissolved solids in the ground water is relatively low throughout the county. In many areas of the county, the soils have very porous layers

Figure 3.—A seepage lake in an area of Keweenaw soils. Most of the lakes in the county are seepage lakes that have no inlet or outlet.

Figure 4.—The Prairie River, in an area of Mequithy soils. The quality of surface water is generally good in areas where the watershed is wooded.

that are poor filters for domestic waste and agricultural chemicals. The impact of development and agriculture may cause deterioration of the ground-water quality in these areas.

History and Settlement

The original inhabitants of the survey area were Woodland Indians, dominantly the Chippewa Tribe after

about 1680. Father Rene Menard, a French Jesuit priest, entered the area in 1661 (Jones and others, 1924). He was later followed by other missionaries, explorers, fur traders, and trappers. They followed the Wisconsin River south from the Lake Superior area. Trading posts were established in areas where major tributaries, such as the Tomahawk, New Wood, and Prairie Rivers, flowed into the Wisconsin River.

The first white man to settle in the county was Francis Bollier. In 1818, he built a cabin in the area near Merrill. More permanent settlements were established during the mid 1800's, when the fur trade declined and the Indians ceded lands. Timber estimators, lumbermen, and homesteaders moved into the area at that time. In 1844, Oliver Barr Smith and his crew of lumberjacks came from Big Bull Falls, now Wausau, to a logging camp that was built at Jenny Bull Falls near the mouth of the Prairie River. Active settlement began at this camp after the development of water power by Andrew Warren in 1847. Warren constructed a dam across the Wisconsin River and built a sawmill. The settlement of Jenny became established near the mill. It grew rapidly after a railroad was built in 1880 that opened southern markets for all kinds of forest and farm products. Jenny was later named Merrill in honor of Sherburn Sanborn Merrill, the general manager of the railroad.

Settlement in the northern part of Lincoln County began in 1886, when the Tomahawk Land and Boom Company, formed by William H. Bradley, established a logging camp several miles south of the present city of Tomahawk. A dam across the Wisconsin River was built at this site to create a lake that was needed to store and sort logs. In 1887, more permanent settlement started at Tomahawk when the railroad was extended to the area from Merrill. The first sawmill, established in 1888, provided employment for the settlers.

Lincoln County was established in 1874 from territory that was formerly part of Marathon County. It was named in honor of Abraham Lincoln, the 16th President of the United States. Several changes were made in the original boundaries that reduced the size of the county. The present boundaries were established in 1885. The county was organized as one township that was later subdivided into 16 townships.

Forestry and Lumbering

Most of Lincoln County was forested prior to settlement. The forests were a mixture of pine, northern hardwoods, hemlock, lowland hardwoods, and swamp conifers. Lumbering began soon after the Chippewa Indians relinquished the land in the Treaty of 1842.

Lumbermen from Wausau, which was then called Big Bull Falls, acquired parcels of land in the county from the Federal government for the harvesting of timber resources. Lumbering began along the Pine, Prairie, and Wisconsin Rivers in the southern part of the county as early as 1844. The pine was cut first, and the other timber was cut later. Many logs were floated downstream to sawmills in Wausau, but some were sent farther downstream. Later, the logs were also hauled by horses and railroads to local sawmills.

The arrival of the railroad to Merrill and Tomahawk opened up the entire region to logging throughout the year. Logs were transported by many railroad routes run by lumber companies.

The first local sawmills were established in the late 1840's. At the peak of the lumbering era, in 1892, eight sawmills were operating along the Wisconsin River. That year, the mills produced 150,000,000 board feet of lumber and 86,000,000 wood shingles. The volume declined rapidly after 1896. The hardwood and hemlock timber came into prominence when the supply of pine diminished. By 1898, 20 sawmills in Lincoln County and the adjoining areas were engaged in the production of hardwood lumber.

Lumbering has remained a major enterprise in the county. In 1985, 108 harvesters and 13 sawmills were harvesting timber (Wisconsin Department of Natural Resources, 1985). About 111,430 cords of growing stock, including 23,061,000 board feet of sawtimber, was removed from the forests in 1982 (USDA, 1984). This harvest was about 71 percent of the net annual growth of growing stock. Hardwoods, mostly aspen and maple, made up about 87 percent of the harvest.

Growing Christmas trees is an important enterprise for about 30 landowners in Lincoln County. Several thousand acres of land is used for the trees, mostly balsam fir, white spruce, Scotch pine, and eastern white pine (fig. 5). Conifer boughs, mostly balsam fir, are harvested by private individuals from plantations and native stands for use as Christmas trimmings. Most of the trees and boughs are transported to southern markets, but many are sold locally.

The collection of sugar maple sap and the production of maple syrup also are important forestry enterprises (fig. 6). The sap is refined into maple syrup or sold to major refineries in the area. The potential for increased production is tremendous because the county has large acreages of sugar maple. Tapping these trees for sap, however, lowers the quality of veneer sawlogs because of staining near the boreholes.

Timber harvesters cut hardwood poletimber for firewood when the pulpwood market is slow. The firewood market fluctuates, however, depending on the

Figure 5.—A young plantation of pruned conifers in an area of Vilas soils.

cost of other types of fuel. It has generally increased in recent years because more homeowners have installed wood-burning furnaces.

Farming

Farming began in Lincoln County in conjunction with lumbering. Clearings were established in areas close to the logging camps where oxen could graze and wild hay could be cut. The oxen were used as draft animals in lumbering. The early farmers later used the clearings to grow other kinds of feed and produce for the lumbermen and oxen. Most farmers worked in the logging camps or sawmills in the winter and enlarged and cultivated their cropland in summer. They used their winter earnings to improve their farms.

Farming progressed slowly until the arrival of the railroad in 1880. The railroad opened southern markets for farm products and provided easy access for more settlers. There were only 153 small farms in 1880. The major crops were hay and oats, but wheat, potatoes, corn, barley, and rye were also grown. The livestock

included cattle, hogs, sheep, horses, and mules.

Most early farmers kept small herds of cows for milk, which was also converted to butter. Dairying started with the sale of surplus milk, cream, and butter. It increased rapidly after the cheese industry was developed about 1905. Over time, dairying became the most important type of agriculture in the county.

The number of farms increased to a high of 2,106 in 1935 (Wisconsin Department of Agriculture, 1957). It has declined since 1935. There were only 507 farms in 1987, but the average farm size had increased to 215 acres. The acreage of farmland reached a high of 256,403 acres in 1950, but only 29 percent was cropland. The rest was mostly woodland. By 1987, farmland had declined to 109,031 acres, but 51 percent was cropland. Between 1950 and 1987, the average cropland per farm increased from 45 to 111 acres.

Dairying is still the main farming enterprise. The trend is toward fewer dairy farms, larger herds, and more efficient husbandry. In recent years, the number of milk cows has remained fairly constant but milk production has increased. The milk is marketed mostly as cheese. The major crops grown to support the dairy agriculture are described under the heading "Crops and Pasture."

Some farming enterprises produce cattle and hogs for meat, sheep for wool, or chickens for eggs. The number of cattle, hogs, and sheep has been relatively stable in recent years. The number of chickens and the production of eggs have greatly decreased since about 1980.

Specialty products produced by some enterprises

Figure 6.—Collection of sugar maple sap in an area of Magnor soils.

include fruits, cranberries, ginseng, honey from bees, maple syrup, Christmas trees, and fur from mink. Some farmers also grow small acreages of vegetable crops for additional income.

Transportation Facilities and Industry

The major north-south access to Lincoln County is provided by U.S. Highway 51 in the central part of the county. The main east-west roads are U.S. Highway 8 in the northern part of the county and State Highway 64 in the southern part. State Highways 17, 86, 91, and 107 also provide access to the county. About 58 percent of the county roads are paved, but many remote areas, such as those in the west-central part of the county, have few good motor roads. Many of these remote areas have old logging roads that permit access by specialized vehicles.

The county also is served by two railroads, two airports, seven motor freight carriers, and one bus line. One railroad provides access to Merrill and Tomahawk from the north and south. It joins the other railroad that provides access to the northern part of the county from the east and west. Major commercial air transportation is available at the airports near Wausau and Rhinelander, in adjoining counties. Smaller aircraft can use the Merrill Municipal Airport or the Tomahawk Regional Airport.

Industry is the most important economic activity in Lincoln County. Based on population, the county has more industrial jobs than the average for the state.

Most industry is related to processing forest products. Many logging companies operate in the county, and lumber is produced by many sawmills. Other forest products produced locally include paperboard containers, paper, pulp for paper, wood chips for pulp, doors, and windows. Small industries produce pallets and specialty wood products, including window grids, architectural wall partitions, moldings, tool handles, cabinets, and furniture.

Some local industries produce wire forms and other metal products, lead products, fiberglass products, plastic material for packaging, sportswear, and shoes. Other industries include construction and printing.

Few agriculture-related industries are in the county, but milk is transported to dairies in adjacent counties. The county has one dairy plant that produces cheese, butter, ice cream, and milk for marketing. One company produces canned vegetables, mainly snap beans.

Mineral production is of minor extent. Sand and gravel are the only mineral resources that are mined. Several industries produce concrete and asphalt from these materials.

The many lakes and streams and the surrounding forested areas provide year-round opportunities for recreation and tourism. A wide variety of outdoor activities, such as fishing, hunting, boating, waterskiing, swimming, camping, hiking, snowmobiling, and cross-country skiing, are enjoyed by visitors and vacationers.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes

Figure 7.—A small pond in an area of the somewhat poorly drained Magnor soils. Generally, such highly contrasting inclusions are indicated by a special symbol on the soil maps.

are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on

crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Some of the soil names on the maps of this soil survey do not agree with those on the maps of surveys in adjacent counties. The differences result from variations in the extent or pattern of the soils in the survey areas. Also, the map units in Lincoln County were designed primarily for woodland use and those in some adjacent counties were designed for other land uses, such as farming.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping (fig. 7). The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

1. Magnor-Freeon-Capitola Association

Somewhat poorly drained, moderately well drained, and very poorly drained, nearly level to sloping, silty and mucky soils on moraines

This association consists mostly of soils on ground moraines that have little local relief and few prominent features, such as lakes, undrained depressions, or areas of hilly topography. Bedrock is close to the surface on slopes that are adjacent to major river valleys. The topography is characterized by broad swells with long smooth side slopes interspersed with long drainageways that broaden into basins in places. The drainageways are frequently ponded during wet periods.

This association makes up about 20 percent of the land area in the county. It is about 67 percent Magnor and similar soils, 14 percent Freeon and similar soils, 9 percent Capitola and similar soils, and 10 percent soils of minor extent.

Magnor soils are somewhat poorly drained and are nearly level and gently sloping. They are on swells and knolls. Typically, the surface layer is very dark gray silt loam about 5 inches thick. The subsurface layer is dark grayish brown, mottled silt loam about 5 inches thick. The next layer is grayish brown and yellowish brown, mottled silt loam about 15 inches thick. The subsoil is reddish brown, mottled, firm sandy loam about 14 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled, firm sandy loam.

Freeon soils are moderately well drained and are gently sloping and sloping. They are on the highest knolls and swells and on the sides of valleys. Typically, the surface layer is very dark gray silt loam about 1 inch thick. The subsurface layer is brown silt loam about 3 inches thick. The next layer is brown and dark yellowish brown silt loam and dark brown and brown, mottled sandy loam about 27 inches thick. The subsoil is reddish brown, mottled, firm sandy loam about 11 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled, firm sandy loam.

Capitola soils are very poorly drained and are nearly level. They are in drainageways, basins, and upland swales. Typically, the surface layer is black muck about 5 inches thick. The subsurface layer is very dark gray, mottled silt loam about 2 inches thick. The subsoil is about 26 inches thick. It is gray and dark grayish brown, mottled silt loam in the upper part and brown, mottled sandy loam in the lower part. The substratum to a depth of about 60 inches is dark brown, mottled sandy loam.

Of minor extent are the very poorly drained, organic Cathro soils in drainageways and basins; the well drained Mequithy soils on summits, shoulders, and sides of bedrock ridges; and the moderately well drained Newood soils, mostly on the sides of valleys.

Many small woodlots and some larger areas of woodland, including many wooded swamps, are in areas of this association. The mature upland woods are mostly red maple and sugar maple in areas of the Magnor soils and sugar maple, American basswood, and white ash in areas of the Freeon soils. The main management concerns are the restricted use of machinery, seedling survival on the Capitola soils, windthrow on the Magnor and Capitola soils, and competing plants that interfere with tree regeneration.

Many of the logging trails are rutted because of low soil strength and wetness.

Many areas are used for farming and are some of the most intensively farmed areas in the county. Dairying is the main farm enterprise. The major crops are corn and oats and a mixture of timothy and red clover or bromegrass and alfalfa for hay and pasture. The crops are grown mostly on the higher soils that have good surface drainage. Some small areas are used as ginseng gardens. Many areas are used as permanent pasture. The main management concerns are wetness on the Magnor soils, water erosion in areas where the slope is more than 2 percent, and crusting of the surface layer.

Many farmsteads and rural homes, part of a city, and a few cottages and landfills are in areas of this association. Sanitary facilities, building sites, and roadways are generally limited in most areas by wetness or ponding and by the slope in some areas of the Freeon soils. Also, restricted permeability limits the use of the soils for sanitary facilities, and frost heave may damage local roads.

2. Ossmer-Minocqua-Sconsin Association

Somewhat poorly drained, very poorly drained, and moderately well drained, nearly level and gently sloping, silty and mucky soils on outwash plains

This association is on outwash plains where most of the soils have a seasonal high water table. The outwash plains are in major river valleys that meander through morainic uplands. The landscape is characterized by low flats interspersed with depressional areas, such as drainageways and basins. The low flats are not much higher than the depressional areas. The drainageways are frequently ponded during wet periods. Many streams are in areas of this unit. Slopes are mostly long and smooth.

This association makes up about 16 percent of the land area in the county. It is about 28 percent Ossmer and similar soils, 24 percent Minocqua and similar soils, 24 percent Sconsin and similar soils, and 24 percent soils of minor extent.

Ossmer soils are somewhat poorly drained and are nearly level and gently sloping. They are on low flats and in swales and drainageways on the higher parts of the landscape. Typically, the surface layer is very dark gray silt loam about 4 inches thick. The subsurface layer is grayish brown, mottled silt loam about 2 inches thick. The next layer is brown and yellowish brown, mottled silt loam about 20 inches thick. The subsoil is dark brown, mottled loam and sandy loam about 12 inches thick. The substratum to a depth of about 60 inches is brown, mottled, stratified sand and gravelly sand.

Minocqua soils are very poorly drained and are nearly level. They are in drainageways and basins and in swales on the higher parts of the landscape. Typically, the surface layer is black muck about 4 inches thick. The subsurface layer is very dark gray silt loam about 1 inch thick. The subsoil is about 32 inches thick. It is gray, greenish gray, and dark greenish gray, mottled silt loam in the upper part; greenish gray, mottled loam in the next part; and dark gray, mottled gravelly sandy loam in the lower part. The substratum to a depth of about 60 inches is dark grayish brown very gravelly sand.

Sconsin soils are moderately well drained and are nearly level and gently sloping. They are on low flats and in swales and drainageways on the higher parts of the landscape. Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 1 inch thick. The next layer is dark brown, dark yellowish brown, and brown silt loam and loam about 29 inches thick. It is mottled in the lower part. The subsoil is dark yellowish brown, mottled sandy loam about 4 inches thick. The substratum to a depth of about 60 inches is yellowish brown, stratified very gravelly sand and sand.

Of minor extent are the loamy, well drained Padus and Pence soils on upland flats and on the sides of drainageways, basins, and ridges and the very poorly drained, organic Cathro, Loxley, and Lupton soils in drainageways and basins.

Many small woodlots and some larger areas of woodland, including many wooded swamps, are in areas of this association. The upland woods are mostly red maple, balsam fir, and quaking aspen in areas of the Ossmer soils and sugar maple, American basswood, and white ash in areas of the Sconsin soils. The main management concerns are the restricted use of machinery, seedling survival on the Minocqua soils, windthrow on the Ossmer and Minocqua soils, and competing plants that interfere with tree regeneration. Many of the logging trails are rutted because of low soil strength and wetness.

Many areas are used for farming. Dairying is the main farm enterprise. The major crops are corn and oats and a mixture of timothy and red clover or bromegrass and alfalfa for hay and pasture. The crops are grown mostly in the higher areas. Many areas are used as permanent pasture. The main management concerns are wetness on the Ossmer soils, water erosion in areas where the slope is more than about 2 percent, and crusting of the surface layer.

Many farmsteads and rural homes, part of a city, and a few villages and cottages are in areas of this

association. Sanitary facilities, building sites, and roadways are generally limited in most areas by wetness or ponding. Also, the effluent from waste disposal facilities can pollute ground water because of the poor filtering capacity of the substratum, and local roads may be damaged by frost heave.

3. Magnor-Lupton-Capitola Association

Somewhat poorly drained and very poorly drained, nearly level and gently sloping, silty and mucky soils on moraines and drumlins

This association is on uplands segmented by long, shallow valleys that are oriented from northwest to southeast. The terrain has little local relief and few areas of surface water, except for small streams in the valleys. Swamps and bogs are in the elongated drainageways and basins. The upland moraines and drumlins commonly have broad crests and gentle slopes. In many places the uplands are mantled by a thin deposit of glacial outwash. Slopes are mostly long and smooth.

This association makes up about 13 percent of the land area in the county. It is about 49 percent Magnor and similar soils, 15 percent Lupton and similar soils, 11 percent Capitola and similar soils, and 25 percent soils of minor extent.

Magnor soils are somewhat poorly drained and are nearly level and gently sloping. They are on knolls and swells of ground moraines, on the broad crests and foot slopes of drumlins, and in upland swales and drainageways. Typically, the surface layer is very dark gray silt loam about 5 inches thick. The subsurface layer is dark grayish brown, mottled silt loam about 5 inches thick. The next layer is grayish brown and yellowish brown, mottled silt loam about 15 inches thick. The subsoil is reddish brown, mottled, firm sandy loam about 14 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled, firm sandy loam.

Lupton soils are very poorly drained and are nearly level. They are in drainageways and basins. Typically, they are dark reddish brown and black muck to a depth of about 60 inches.

Capitola soils are very poorly drained and are nearly level. They are in drainageways, basins, and upland swales. Typically, the surface layer is black muck about 5 inches thick. The subsurface layer is very dark gray, mottled silt loam about 2 inches thick. The subsoil is about 26 inches thick. It is gray and dark grayish brown, mottled silt loam in the upper part and brown, mottled sandy loam in the lower part. The substratum to a depth of about 60 inches is dark brown, mottled sandy loam.

Of minor extent are the loamy, somewhat poorly drained Pesabic soils in positions on the landscape similar to those of the Magnor soils; the moderately well drained Freeon and Newood soils on the higher parts of the landscape and on the sides of valleys, basins, and drainageways; and the well drained Padus and Pence soils, which formed in outwash deposits on valley slopes.

Most of the acreage is woodland, including many wooded swamps. The mature upland woods are mostly red maple and sugar maple. The main management concerns are the restricted use of machinery, seedling survival on the Capitola and Lupton soils, windthrow, and competing plants that interfere with tree regeneration. Many of the logging trails are rutted because of low soil strength and wetness.

A few small areas of the Magnor soils are used for farming. Dairying is the main farm enterprise. The major crops are corn and oats. Grasses and legumes are grown for hay and pasture. Some small areas are used as permanent pasture. The main management concerns are wetness, water erosion in areas where the slope is more than 2 percent, and crusting of the surface layer.

A few farmsteads, rural homes, cottages, and villages are in areas of this association. Sanitary facilities, building sites, and roadways are generally limited in most areas by wetness or ponding and by potential subsidence in the Lupton soils. Also, restricted permeability limits the use of Capitola and Magnor soils for sanitary facilities, and frost heave may damage local roads. Because of low strength, the organic Lupton soils are not suitable for dwellings.

4. Sarona-Keweenaw-Goodman Association

Well drained, rolling to very steep, loamy and silty soils on moraines

This association consists mostly of soils on terminal and recessional end moraines. The end moraines have the highest elevations and some of the roughest terrain in the county. In most areas the swells, hills, and ridges are interspersed with many small kettles and lake basins and a few narrow drainage valleys. Many of the kettles and lake basins contain lakes, ponds, bogs, or swamps. Slopes are mostly short and complex.

This association makes up about 12 percent of the land area in the county. It is about 35 percent Sarona and similar soils, 34 percent Keweenaw and similar soils, 9 percent Goodman and similar soils, and 22 percent soils of minor extent.

Sarona soils are rolling to very steep. They are on swells, hills, and ridges. Typically, the surface layer is very dark gray sandy loam about 3 inches thick. The subsurface layer is brown sandy loam about 2 inches

thick. The subsoil is dark reddish brown, reddish brown, and dark brown sandy loam about 13 inches thick. Below this to a depth of about 60 inches is reddish brown and brown sandy loam and brown loamy sand.

Keweenaw soils are rolling to very steep. They are on swells, hills, and ridges. Typically, the surface layer is very dark gray sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is dark reddish brown and reddish brown sandy loam and dark brown loamy sand about 16 inches thick. Below this to a depth of about 60 inches is brown sand, brown and reddish brown loamy sand, and reddish brown and dark reddish brown sandy loam.

Goodman soils are rolling. They are on swells, hills, and ridges. Typically, the surface layer is very dark gray silt loam about 5 inches thick. The subsurface layer is brown silt loam about 1 inch thick. The next layer is about 28 inches thick. It is dark brown and brown silt loam in the upper part and reddish brown and brown sandy loam in the lower part. The subsoil is reddish brown sandy loam about 16 inches thick. The substratum to a depth of about 60 inches also is reddish brown sandy loam.

Of minor extent are the very poorly drained Capitola soils and the very poorly drained, organic Cathro, Loxley, and Lupton soils in drainageways, kettles, and basins; the moderately well drained Crystal Lake and somewhat poorly drained Comstock soils in lake basins; and the somewhat poorly drained Hatley and Moodig soils in upland swales and drainageways and on small swells and knolls in low areas.

Most of the acreage is woodland, including many very small, wooded swamps (fig. 8). The mature upland woods are mostly sugar maple in areas of the Sarona soils; red maple, sugar maple, paper birch, and northern red oak in areas of the Keweenaw soils; and sugar maple, American basswood, and white ash in areas of the Goodman soils. The main management concerns are erosion and seedling survival on the steeper slopes, the restricted use of machinery on the steeper slopes and on the Goodman and Sarona soils during wet periods, and competing plants that interfere with tree regeneration.

Some areas are used for farming. Dairying is the main farm enterprise. The major crops are corn and oats and a mixture of bromegrass and alfalfa for hay and pasture. The crops are grown mostly on the less sloping soils. Some areas are used as permanent pasture. The main management concerns are water erosion, soil blowing on the Sarona and Keweenaw soils, crusting of the surface layer on the Goodman soils, and the low fertility and low available water capacity of the Keweenaw soils.

Many rural homes and cottages, some farmsteads, and a few villages and landfills are in areas of this association. Generally, the soils have few limitations affecting sanitary facilities or building site development, except for the slope. Local roads on the Goodman and Sarona soils may be damaged by frost heave. This association has more potential sites for landfills than the other associations in the county.

5. Newood-Magnor-Freeon Association

Moderately well drained and somewhat poorly drained, nearly level to rolling, loamy and silty soils on moraines

This association encompasses an end moraine where the terrain is rough, except within the small ice-contact lake basins that occupy the highest elevations. The lower landscape between the lake basins consists of knolls, swells, hills, and ridges intermingled with depressional areas, such as small kettles, basins, and narrow drainageways that contain bogs and swamps. Slopes are mostly short and complex, except in the lake basins.

This association makes up about 11 percent of the land area in the county. It is about 29 percent Newood and similar soils, 28 percent Magnor and similar soils, 19 percent Freeon and similar soils, and 24 percent soils of minor extent.

Newood soils are moderately well drained and are undulating and rolling. They are on knolls, swells, hills, and ridges. Typically, the surface layer is very dark gray sandy loam about 4 inches thick. The subsurface layer is brown gravelly sandy loam about 1 inch thick. The next layer is dark brown, brown, and reddish brown gravelly sandy loam about 32 inches thick. The subsoil is reddish brown, mottled, firm gravelly sandy loam and sandy loam about 21 inches thick. The substratum to a depth of about 60 inches is reddish brown, firm sandy loam.

Magnor soils are somewhat poorly drained and are nearly level and undulating. They are on knolls and swells, on the lower parts of glacial lake basins, and in upland swales and drainageways. Typically, the surface layer is very dark gray silt loam about 5 inches thick. The subsurface layer is dark grayish brown, mottled silt loam about 5 inches thick. The next layer is grayish brown and yellowish brown, mottled silt loam about 15 inches thick. The subsoil is reddish brown, mottled, firm sandy loam about 14 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled, firm sandy loam.

Freeon soils are moderately well drained and are undulating and rolling. They are on knolls, swells, hills, and ridges. Typically, the surface layer is very dark gray silt loam about 1 inch thick. The subsurface layer is brown silt loam about 3 inches thick. The next layer is

Figure 8.—A typical area of the Sarona-Keweenaw-Goodman association. Most of the acreage is woodland dominated by northern hardwoods.

brown and dark yellowish brown silt loam and dark brown and brown, mottled sandy loam about 27 inches thick. The subsoil is reddish brown, mottled, firm sandy loam about 11 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled, firm sandy loam.

Of minor extent are the very poorly drained Capitola soils and the very poorly drained, organic Cathro, Loxley, and Lupton soils in drainageways, kettles, and basins; the moderately well drained Crystal Lake and somewhat poorly drained Comstock soils in lake basins; and the somewhat poorly drained Pesabic soils in upland swales and drainageways and on small swells and knolls in low areas.

Most of the acreage is woodland, including many very small, wooded swamps. The mature upland woods are mostly red maple, sugar maple, eastern hemlock, paper birch, and northern red oak in areas of the Newood soils; sugar maple, American basswood, and white ash in areas of the Freeon soils; and red maple

and sugar maple in areas of the Magnor soils. The main management concerns are the restricted use of machinery during wet periods, windthrow on the Magnor soils, and competing plants that interfere with tree regeneration.

A few small areas are used for farming. Dairying is the main farm enterprise. The major crops are corn and oats. Grasses and legumes are grown for hay and pasture. Some small areas are used as permanent pasture. The main management concerns are wetness on the Magnor soils, water erosion in areas where the slope is more than 2 percent, soil blowing on the Newood soils, and crusting of the surface layer on the Freeon and Magnor soils.

Many rural homes and a few farmsteads are in areas of this association. Sanitary facilities, building sites, and roadways are generally limited in many areas by wetness and by the slope in the rolling areas of Freeon and Newood soils. Also, restricted permeability limits the use of the soils for sanitary facilities, and frost heave may damage local roads.

6. Sarwet-Moodig-Lupton Association

Moderately well drained, somewhat poorly drained, and very poorly drained, nearly level and gently sloping, loamy and mucky soils on moraines and drumlins

This association has a terrain of low recessional moraines and drumlins intermingled with swamps and bogs. The landscape has few areas of surface water and little local relief. The swamps and bogs are only slightly lower in elevation than the crests of the moraines and drumlins. The landscape features are linear in the drumlin areas. They are oriented from northwest to southeast. The drumlins have broad crests and gentle slopes. Many of the upland areas have a thin surface veneer of outwash deposits. These glacial meltwater deposits are thicker on the foot slopes that border the swamps and bogs. Slopes are mostly long and smooth.

This association makes up about 7 percent of the land area in the county. It is about 40 percent Sarwet and similar soils, 29 percent Moodig and similar soils, 20 percent Lupton and similar soils, and 11 percent soils of minor extent.

Sarwet soils are moderately well drained and are gently sloping. They are on knolls and swells of ground moraines and on the crests and sides of drumlins. Typically, the surface layer is very dark gray sandy loam about 5 inches thick. The subsurface layer is brown sandy loam about 1 inch thick. The upper part of the subsoil is dark brown sandy loam about 16 inches thick. Below this is about 49 inches of mostly pale brown and brown, mottled gravelly sandy loam. The lower part of the subsoil is brown, mottled gravelly sandy loam about 13 inches thick. The substratum to a depth of about 90 inches is brown very gravelly sandy loam.

Moodig soils are somewhat poorly drained and are nearly level and gently sloping. They are on small swells and knolls in low areas, on the broad crests and foot slopes of drumlins, and in upland swales and drainageways. Typically, the surface layer is very dark gray sandy loam about 3 inches thick. The subsurface layer is brown gravelly sandy loam about 2 inches thick. The upper part of the subsoil is dark brown, mostly mottled sandy loam and gravelly sandy loam about 17 inches thick. Below this is about 31 inches of mostly brown, mottled sandy loam and gravelly sandy loam and some brown, mottled loamy sand and gravelly loamy sand. The lower part of the subsoil is brown, mottled gravelly sandy loam about 20 inches thick. The substratum to a depth of about 95 inches is brown gravelly sandy loam.

Lupton soils are very poorly drained and are nearly level. They are in drainageways and basins. Typically, they are dark reddish brown and black muck to a depth of about 60 inches.

Of minor extent are the very poorly drained Capitola and similar soils in drainageways, basins, and upland swales and the moderately well drained Croswood and excessively drained Vilas soils on sandy knolls and flats that occupy valley foot slopes.

Most of the acreage is woodland, including many wooded swamps. The mature upland woods are mostly sugar maple in areas of the Sarwet soils and red maple and sugar maple in areas of the Moodig soils. The main management concerns are the restricted use of machinery, seedling survival on the Lupton soils, windthrow on the Moodig and Lupton soils, and competing plants that interfere with tree regeneration.

A few upland areas are used for farming. Dairying is the main farm enterprise. The major crops are corn and oats. Grasses and legumes are grown for hay and pasture. Some small areas are used as permanent pasture. The main management concerns are wetness on the Moodig soils, water erosion in areas where the slope is more than 2 percent, and soil blowing.

Many rural homes and a few farmsteads, cottages, villages, and landfills are in areas of this association. Sanitary facilities, building sites, and roadways are generally limited in most areas by wetness or ponding and by potential subsidence in the Lupton soils. Also, local roads may be damaged by frost heave. Because of low strength, the organic Lupton soils are not suitable for dwellings.

7. Vilas-Croswell-Markey Association

Excessively drained, moderately well drained, and very poorly drained, nearly level to sloping, sandy and mucky soils on outwash plains

This association consists of soils on outwash plains that have little local relief. The topography is relatively flat, except for a few morainic mounds that protrude upward slightly higher than the level of the plain and a long, prominent esker that extends from northwest to southeast along the Somo River. Depressional areas, such as drainageways and basins, are common throughout the outwash plain. Streams, lakes, swamps, bogs, and marshes are in these lower areas. This association contains much of the surface-water area in the county. Slopes are mostly long and smooth, except for the short slopes adjacent to depressional areas.

This association makes up about 6 percent of the land area in the county. It is about 48 percent Vilas and similar soils, 19 percent Croswell and similar soils, 19 percent Markey and similar soils, and 14 percent soils of minor extent.

Vilas soils are excessively drained and are mostly nearly level to sloping. They are on upland flats; on knolls, swells, hills, and ridges; and on side slopes that border drainageways, kettles, and basins. Typically, the surface layer is very dark gray loamy sand about 2 inches thick. The subsurface layer is brown loamy sand about 1 inch thick. The subsoil is about 27 inches thick. It is dark reddish brown and dark brown loamy sand in the upper part and strong brown and yellowish brown sand in the lower part. The substratum to a depth of about 60 inches is light yellowish brown sand.

Croswell soils are moderately well drained and are nearly level and gently sloping. They are on low flats and in swales and drainageways on the higher parts of the landscape. Typically, the surface layer is very dark gray loamy sand about 3 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 26 inches thick. It is dark reddish brown loamy sand in the upper part and dark brown and yellowish brown sand in the lower part. It is mottled in the lower 7 inches. The substratum to a depth of about 60 inches is yellowish red and brown, mottled sand.

Markey soils are very poorly drained and are nearly level. They are in drainageways, basins, and kettles. Typically, they have an upper layer of black and dark brown muck about 36 inches thick. The substratum to a depth of about 60 inches is dark grayish brown sand.

Of minor extent are the poorly drained and very poorly drained, alluvial Fordum soils in drainageways adjacent to streams; the somewhat poorly drained Au Gres soils on low flats and in upland swales and drainageways; the moderately well drained Sarwet soils on the higher morainic mounds; and the loamy, well drained Pence and Padus soils on and near the Somo River esker.

Most of the acreage is woodland, including many wooded swamps. Many pine plantations also are in areas of this association (fig. 9). The mature upland woods are mostly red maple, northern red oak, paper birch, eastern white pine, and red pine. On the Markey soils, the main management concerns are the restricted use of machinery, seedling survival, windthrow, and competing plants that interfere with tree regeneration. Competing plants also are a concern on the Croswell soils. During dry periods, loose sand can interfere with the traction of wheeled equipment on the Vilas and Croswell soils. Seedling survival during dry periods also is a management concern on the droughty Vilas and Croswell soils.

Some upland areas are used for farming. Many areas formerly used as cropland are now idle or have been planted to pine trees. Dairying is the main farm enterprise. The major crop is oats, and grasses and legumes are grown for hay and pasture. Crops are grown mostly in the less sloping areas. A few areas are used as permanent pasture. The main management concerns are soil blowing and the low fertility and available water capacity of the upland soils.

Many rural homes and cottages, a city, and a few farmsteads, villages, and landfills are in areas of this association. Sanitary facilities, building sites, and roadways are generally limited on the Markey soils by ponding and by potential subsidence in the upper part. Except for roadways, the Croswell soils are generally limited by wetness. The Vilas soils have few limitations affecting urban uses, except for the slope in some areas. Also, the effluent from waste disposal facilities can pollute ground water because of the poor filtering capacity of the soils, and local roads on the Markey soils may be damaged by frost heave. Because of low strength in the upper, organic part, the Markey soils are not suitable for dwellings.

8. Lupton-Padwet-Minocqua Association

Very poorly drained and moderately well drained, nearly level and gently sloping, mucky and loamy soils on outwash plains

This association consists mostly of soils in flow channels created by glacial meltwater. It encompasses some of the lowest positions on the landscape and includes small swells, hills, ridges, and flat remnants of outwash plains. Many of the flats border the valley slopes of adjacent uplands. The association also includes some isolated morainic knolls and swells and many streams. The channel floors of the streams are

Figure 9.—Red pine planted in an area of the Vilas-Croswell-Markey association.

frequently ponded during wet periods. Slopes generally are long and smooth.

This association makes up about 5 percent of the land area in the county. It is about 34 percent Lupton and similar soils, 30 percent Padwet and similar soils, 8 percent Minocqua and similar soils, and 28 percent soils of minor extent.

Lupton soils are very poorly drained and are nearly level. They are in drainageways and basins. Typically, they are dark reddish brown and black muck to a depth of about 60 inches.

Padwet soils are moderately well drained and are nearly level and gently sloping. They are on knolls and low flats and in swales and drainageways on the higher parts of the landscape. Typically, the surface layer is black sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 3 inches thick. The next layer is brown and dark brown sandy loam about 29 inches thick. It is mottled in the lower part. The subsoil is dark brown, mottled sandy loam about 5 inches thick. The substratum to a depth of about 60 inches is yellowish brown sand.

Minocqua soils are very poorly drained and are nearly level. They are in drainageways and basins and in swales on the higher parts of the landscape. Typically, the surface layer is black muck about 4 inches thick. The subsurface layer is very dark gray silt loam about 2 inches thick. The subsoil is about 32 inches thick. It is gray, greenish gray, and dark greenish gray, mottled silt loam in the upper part; greenish gray, mottled loam in the next part; and dark gray, mottled gravelly sandy loam in the lower part. The substratum to a depth of about 60 inches is dark grayish brown very gravelly sand.

Of minor extent are the somewhat poorly drained Worcester soils on low flats and in upland swales and drainageways; the somewhat poorly drained Augwood and moderately well drained Croswell soils on low, sandy flats; the excessively drained Vilas soils on swells, hills, and ridges of sandy outwash and on sandy flats; and the moderately well drained Sarwet soils on isolated knolls and swells of moraines.

Most of the acreage is woodland, including many wooded swamps. The mature upland woods are mostly sugar maple. The main management concerns are the restricted use of machinery, seedling survival and windthrow on the Minocqua and Lupton soils, and competing plants that interfere with tree regeneration.

A few areas of the Padwet soils are used for farming. Dairying is the main farm enterprise. The major crops are corn and oats, and grasses and legumes are grown for hay and pasture. Some small areas are used as permanent pasture. The main management concerns are water erosion in areas where the slope is more than 2 percent and soil blowing.

Many rural homes and cottages and a few farmsteads are in areas of this association. Sanitary facilities, building sites, and roadways are generally limited in most areas by wetness or ponding and by potential subsidence in the Lupton soils. Also, the effluent from waste disposal facilities in areas of the Padwet and Minocqua soils can pollute ground water because of the poor filtering capacity of the substratum, and local roads may be damaged by frost heave. Because of low strength, the organic Lupton soils are not suitable for dwellings.

9. Pence-Padus-Antigo Association

Well drained, nearly level to very steep, loamy and silty soils on outwash plains

This association consists mostly of soils in outwash areas that are made up of knolls, swells, hills, and ridges and are characterized by undulating to hilly topography. The landscape includes some small, nearly level, rather flat outwash plains that are pitted with kettles. The terrain also contains basins and drainageways. Many of the depressional areas contain lakes, streams, ponds, bogs, or swamps. Slopes range from nearly level and smooth to very steep and complex.

This association makes up about 5 percent of the land area in the county. It is about 32 percent Pence and similar soils, 19 percent Padus and similar soils, 18 percent Antigo and similar soils, and 31 percent soils of minor extent.

Pence soils are nearly level to very steep. They are on upland flats; on knolls, swells, hills, and ridges; and on the sides of drainageways, valleys, kettles, and basins. Typically, the surface layer is very dark gray sandy loam about 3 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is about 22 inches thick. It is dark brown sandy loam in the upper part and strong brown very gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown, stratified gravelly sand and very gravelly sand.

Padus soils are nearly level to very steep. They are on upland flats; on knolls, swells, hills, and ridges; and on the sides of drainageways, valleys, kettles, and basins. Typically, the surface layer is very dark gray sandy loam about 4 inches thick. The subsurface layer is brown sandy loam about 6 inches thick. The next layer is dark reddish brown, brown, and dark brown sandy loam about 13 inches thick. The subsoil is about 16 inches thick. It is dark brown sandy loam in the upper part and dark brown very gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is brown, stratified gravelly sand and sand.

Antigo soils are nearly level to sloping or rolling. They are on upland flats; on knolls, swells, hills, and ridges; and on the sides of drainageways, valleys, kettles, and basins. Typically, the surface layer is very dark grayish brown silt loam about 1 inch thick. The subsurface layer is grayish brown silt loam about 3 inches thick. The next layer is dark yellowish brown and brown silt loam about 24 inches thick. The subsoil is about 9 inches thick. It is dark yellowish brown silt loam in the upper part and dark brown sandy loam in the lower part. The substratum to a depth of about 60 inches is brown gravelly sand.

Of minor extent are the very poorly drained Minocqua soils and the very poorly drained, organic Loxley and Lupton soils in depressions; the somewhat poorly drained Ossmer and Worcester soils on low flats and in upland swales and drainageways; and the sandy Sayner and Vilas soils in positions on the landscape similar to those of the major soils.

Most of the acreage is woodland, including a few wooded swamps. The mature upland woods are mostly

sugar maple, paper birch, and red maple in areas of the Pence soils; sugar maple in areas of the Padus soils; and sugar maple, American basswood, and white ash in areas of the Antigo soils. The main management concerns are erosion and seedling survival on the steeper slopes, the restricted use of machinery on the steeper slopes and on the Antigo and Padus soils during wet periods, and competing plants that interfere with tree regeneration on the Antigo and Padus soils.

Some areas are used for farming. Dairying is the main farm enterprise. The major crops are corn and oats, and a mixture of bromegrass and alfalfa is grown for hay and pasture. Crops are grown mostly on the less sloping soils. Some areas are used as permanent pasture. The main management concerns are water erosion in areas where the slope is more than 2 percent, soil blowing on the Padus and Pence soils, crusting of the surface layer on the Antigo soils, and the low fertility and low available water capacity of the Pence soils.

Many rural homes and a few farmsteads, cottages, villages, and landfills are in areas of this association. Generally, the soils have few limitations affecting sanitary facilities or building site development. The slope, however, is a limitation in the sloping or rolling to very steep areas. Also, the effluent from waste disposal facilities can pollute ground water because of the poor filtering capacity of the substratum. Local roads on the Antigo and Padus soils may be damaged by frost heave. The substratum of these soils is a probable source of sand and gravel.

10. Vilas-Sayner-Keweenaw Association

Excessively drained and well drained, rolling to very steep, sandy and loamy soils on outwash plains and moraines

This association consists mostly of soils that formed in ridges of glacial drift deposited along the edge of a glacier that was retreating downslope to the northwest. The ridges of drift are fronted by areas of outwash and contain knolls, hills, and ridges of glacial outwash interspersed with morainic uplands. The outwash was most likely deposited by meltwater flowing southwest along the margin of the glacial ice. Areas of this association have a rough, complex topography and contain many small kettles, basins, and narrow drainageways. Many of the depressional areas have no drainage outlet. Slopes are short and complex.

This association makes up about 3 percent of the land area in the county. It is about 30 percent Vilas and similar soils, 22 percent Sayner and similar soils, 17 percent Keweenaw and similar soils, and 31 percent soils of minor extent.

Vilas soils are excessively drained and are on the glacial outwash parts of the landscape. They are on swells, hills, and ridges and on the sides of valleys, kettles, and basins. Typically, the surface layer is black loamy sand about 3 inches thick. The subsurface layer is brown loamy sand about 1 inch thick. The subsoil is about 23 inches thick. It is dark brown loamy sand in the upper part and strong brown sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand.

Sayner soils are excessively drained and are on the glacial outwash parts of the landscape. They are on swells, hills, and ridges and on the sides of valleys, kettles, and basins. Typically, the surface layer is very dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 3 inches thick. The subsoil is about 22 inches thick. It is dark reddish brown and reddish brown loamy sand in the upper part and brown sand in the lower part. The substratum to a depth of about 60 inches is light yellowish brown, stratified gravelly sand and sand.

Keweenaw soils are well drained and are on the morainic parts of the landscape. They are on swells, hills, and ridges. Typically, the surface layer is very dark gray sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is dark reddish brown and reddish brown sandy loam and dark brown loamy sand about 16 inches thick. Below this to a depth of about 60 inches is brown sand, brown and reddish brown loamy sand, and reddish brown and dark reddish brown sandy loam.

Of minor extent are the very poorly drained, organic Dawson, Loxley, Markey, and Lupton soils in kettles, basins, and drainageways and the loamy, well drained Padus and Pence soils on swells, hills, and ridges of glacial outwash.

Most of the acreage is woodland, including a few small wooded swamps. The mature upland woods are mostly red maple, northern red oak, paper birch, eastern white pine, and red pine. Areas of the Keweenaw soils also support sugar maple. On the steeper slopes, the restricted use of machinery and erosion are management concerns. On the Keweenaw soils, competing plants can interfere with tree regeneration. During dry periods, loose sand can interfere with the traction of wheeled equipment on the Vilas soils. Seedling survival during dry periods is a management concern on these droughty soils, especially on the steeper, southern exposures.

A few small areas are used for farming. Dairying is the main farm enterprise. The major crop is oats, and grasses and legumes are grown for hay and pasture.

Crops are grown mostly on the less sloping soils. A few areas are used as permanent pasture. The main management concerns are soil blowing and the low fertility and low available water capacity of the soils.

A few farmsteads, rural homes, cottages, and landfills are in areas of this association. Generally, the soils have few limitations affecting sanitary facilities, building site development, or roadways, except for the slope. Because of a poor filtering capacity in areas of the Sayner and Vilas soils, however, the effluent from waste disposal facilities can pollute ground water.

11. Croswood-Lupton-Augwood Association

Moderately well drained, very poorly drained, and somewhat poorly drained, nearly level and gently sloping, sandy and mucky soils on outwash-veneered moraines and drumlins

This association has a landscape characterized by little local relief and few areas of surface water, except for several small streams. The terrain features are generally linear and oriented from northwest to southeast. The elongated or oval drumlins and the moraines are separated by long, shallow drainage valleys that contain swamps. The upland ridges have broad crests and gentle slopes. They are mostly glacial till that is veneered with sandy outwash deposits. The surficial sandy deposits commonly are thicker on the foot slopes that border the swamps and thinner on the highest crests. Slopes are mostly long and smooth.

This association makes up about 2 percent of the land area in the county. It is about 44 percent Croswood and similar soils, 28 percent Lupton and similar soils, 19 percent Augwood and similar soils, and 9 percent soils of minor extent.

Croswood soils are moderately well drained and are nearly level and gently sloping. They are on knolls and swells of ground moraines and on the broad crests and sides of drumlins. Typically, the surface layer is very dark gray loamy sand about 4 inches thick. The subsurface layer is dark grayish brown and grayish brown sand about 2 inches thick. The subsoil is about 25 inches thick. It is dark reddish brown loamy sand in the upper part and dark brown and strong brown sand in the lower part. It is mottled in the lower 9 inches. The upper 24 inches of the substratum is brown, mottled sand. Below this to a depth of about 60 inches is mostly brown, mottled gravelly loamy sand.

Lupton soils are very poorly drained and are nearly level. They are in drainageways and basins. Typically, they are dark reddish brown and black muck to a depth of about 60 inches.

Augwood soils are somewhat poorly drained and are nearly level and gently sloping. They are on small swells and knolls in low areas, on foot slopes of moraines and drumlins, and in upland swales and drainageways. Typically, the surface layer is very dark gray loamy sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 33 inches thick. It is dark reddish brown, mottled loamy sand in the upper part and dark brown and strong brown, mottled sand in the lower part. The upper 19 inches of the substratum is brown, mottled sand. Below this to a depth of about 60 inches is brown, mottled sandy loam.

Of minor extent are the moderately well drained Sarwet soils on the crests of drumlins and moraines and the excessively drained Vilas soils on sandy knolls and flats that occupy valley foot slopes.

Most of the acreage is woodland, including some wooded swamps. Many pine plantations also are in areas of this association. The mature upland woods are mostly red maple, northern red oak, paper birch, eastern white pine, and red pine in areas of the Croswood soils and red maple, red pine, paper birch, quaking aspen, and balsam fir in areas of the Augwood soils. On the Lupton and Augwood soils, the main management concerns are the restricted use of equipment, seedling survival, and windthrow. Competing plants that interfere with tree regeneration are a concern on all of the major soils. During dry periods, loose sand can interfere with the traction of wheeled equipment on the Croswood soils. Seedling survival during dry periods is a management concern on the seasonally droughty Croswood soils.

A few small areas of the Croswood soils are used for farming. Dairying is the main farm enterprise. The major crop is oats, and grasses and legumes are grown for hay and pasture. A few areas are used as permanent pasture. The main management concerns are soil blowing and the low fertility and low available water capacity of the soils.

A few farmsteads, rural homes, and landfills are in areas of this association. Sanitary facilities, building sites, and roadways are generally limited in most areas by wetness or ponding and by potential subsidence in the Lupton soils. Also, restricted permeability in the loamy part of the Augwood and Croswood soils limits their use for sanitary facilities. Effluent from waste disposal facilities on these soils can pollute ground water because of the poor filtering capacity of the upper sandy deposits. Local roads on the Augwood and Lupton soils may be damaged by frost heave. Because of low strength, the organic Lupton soils are not suitable for dwellings.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under the heading "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Antigo silt loam, 1 to 6 percent slopes, is a phase of the Antigo series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or three soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Pence-Antigo complex, 6 to 15 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Lupton, Cathro, and Markey mucks, 0 to 1 percent slopes, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

AoB—Antigo silt loam, 1 to 6 percent slopes. This nearly level and gently sloping or undulating, well drained soil is on knolls and upland flats, in the higher parts of glacial lake basins, and on the sides of drainageways, kettles, and basins. The landscape is pitted in places. Areas are elongated or irregularly shaped and range from about 10 to 200 acres in size.

Typically, the surface layer is very dark gray silt loam about 4 inches thick. The next layer is dark yellowish brown and brown silt loam about 17 inches thick. The subsoil is dark brown loam and gravelly sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is brown, stratified very gravelly sand and sand. In some areas the upper layers are loam. In

places the substratum is at a depth of more than 40 inches, and in a few places it has thin layers of loamy deposits. It is cobbly in some areas. In places the slope is 6 to 15 percent. In a few places the upper silty deposits are more than 30 inches thick.

Included with this soil in mapping are small areas of Ossmer, Padus, Pence, and Sconsin soils. The somewhat poorly drained Ossmer and moderately well drained Sconsin soils are in swales and other lower parts of the landscape. The well drained Padus and Pence soils are on the crests of knolls and on the sides of drainageways. They have a surface layer of sandy loam. Pence soils are shallower to sand and gravel than the Antigo soil. Also included are areas where loamy till is within a depth of 60 inches; areas where a perched seasonal high water table is in the subsoil; narrow areas that have steep slopes; and small ponds, wet spots, very stony areas, gravel pits, and depressions. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Antigo soil and rapid or very rapid in the lower part. Runoff is slow or medium. The available water capacity is moderate. The content of organic matter in the surface layer is moderate or moderately low. The potential for frost action is high. The surface layer can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after rainfall. In places, the rooting depth of some plants is limited by the sand and gravel substratum.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch and black cherry are in most stands. The ground flora includes blue cohosh, sweet cicely, four-lined honeysuckle, smooth yellow violet, ladyfern, Virginia waterleaf, largeflowered bellwort, snow trillium, and bloodroot.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. The substratum is droughty and may be difficult to vegetate if exposed during the construction of diversions, grassed waterways, or terraces. Land smoothing in nearly level areas can prevent the crop damage caused by ponding. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, help to prevent crusting and puddling of the surface layer, and conserve the water available for plant growth. They also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

This soil is suited to pasture. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity of the substratum may result in the pollution of ground water. The soil is suited to dwellings, but the substratum may cave in if it is excavated. The soil is poorly suited to local roads because of the risk of frost damage. Frost action can be controlled by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts. The substratum is a probable source of sand and gravel.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is AViO or ATM. The secondary habitat type commonly is AH.

AoC—Antigo silt loam, 6 to 15 percent slopes. This sloping or rolling, well drained soil is on swells, hills, and ridges and on the sides of valleys, kettles, and glacial lake basins. Areas are elongated or irregularly shaped and range from about 10 to 200 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 1 inch thick. The subsurface layer is grayish brown silt loam about 3 inches thick. The next layer is dark yellowish brown and brown silt loam about 24 inches thick. The subsoil is about 9 inches thick. It is dark yellowish brown silt loam in the upper part and dark brown sandy loam in the lower part. The substratum to a depth of about 60 inches is brown gravelly sand. In some areas the upper layers are loam. In places the substratum is at a depth of more than 40 inches, and in a few places it has thin layers of loamy deposits. It is cobbly in some areas. In places the slope is less than 6 percent.

Included with this soil in mapping are small areas of Ossmer, Padus, Pence, and Sconsin soils. The somewhat poorly drained Ossmer and moderately well drained Sconsin soils are in the lower positions on the landscape. The well drained Padus and Pence soils are in landscape positions similar to those of the Antigo soil. They have a surface layer of sandy loam. Pence soils are shallower to sand and gravel than the Antigo soil. Also included are areas where loamy till is within a depth of 60 inches; small areas where the slope is more than 15 percent; and small ponds, wet spots, very stony areas, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Antigo soil and rapid or very rapid in the lower part. Runoff is medium. The available water capacity is moderate. The content of organic matter in the surface layer is moderate or moderately low. The potential for frost action is high. The surface layer can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after rainfall. In places, the rooting depth of some plants is limited by the sand and gravel substratum.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch and black cherry are in most stands. The ground flora includes blue cohosh, sweet cicely, four-lined honeysuckle, smooth yellow violet, ladyfern, Virginia waterleaf, largeflowered bellwort, snow trillium, and bloodroot.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. The slope limits the selection of landing sites. Landings can be established on better suited included or adjacent soils that are nearly level or gently sloping.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish. The substratum is droughty and may be difficult to vegetate if exposed during the construction of diversions or grassed waterways. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, help to prevent crusting and puddling of the surface layer, conserve the water available for plant growth, and help to prevent excessive water erosion.

This soil is suited to pasture. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity of the substratum may result in the pollution of ground water. The soil is only moderately suited to dwellings because of the slope. It is poorly suited to local roads because of the risk of frost damage. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. The substratum may cave in if it is excavated.

It is droughty and is difficult to vegetate if it is exposed by land shaping. Frost damage to local roads can be controlled by replacing the upper part of the soil with coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts. The substratum is a probable source of sand and gravel.

The land capability classification is IIIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is AViO or ATM. The secondary habitat type commonly is AH.

AuA—Au Gres loamy sand, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on low flats and in swales and drainageways in the uplands. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are elongated or irregularly shaped and range from about 10 to several hundred acres in size.

Typically, the surface layer is black loamy sand about 2 inches thick. The subsurface layer is grayish brown and dark grayish brown sand about 3 inches thick. The subsoil is about 27 inches thick. It is dark reddish brown, mottled loamy sand in the upper part and dark brown and brown, mottled sand in the lower part. The substratum to a depth of about 60 inches is brown, mottled sand. In some areas the surface layer is sand. In places the substratum is loamy sand. In a few places the soil has thin layers of gravelly sand or very gravelly sand.

Included with this soil in mapping are small areas of very poorly drained soils in depressions, the somewhat poorly drained Augwood soils in areas where loamy till is at a depth of 40 to 60 inches, and the moderately well drained Croswell and excessively drained Vilas soils on the higher parts of the landscape. Also included are areas where the soil has thin layers of loamy deposits, areas where the sand fraction is fine or very fine, areas where the surface soil is sandy loam or fine sandy loam, and small ponds. Included areas make up less than 15 percent of the map unit.

Permeability is rapid in the Au Gres soil. Runoff is very slow. The available water capacity and natural fertility are low. The content of organic matter in the surface layer is moderate. The potential for frost action also is moderate. A seasonal high water table is at a depth of 0.5 foot to 1.5 feet. It limits the rooting depth of some plants.

Most areas are used as woodland. The timber stands are mostly red maple, red pine, paper birch, quaking aspen, and balsam fir, but yellow birch, eastern hemlock, eastern white pine, jack pine, and northern red oak are in most stands. The ground flora includes blueberry, bunchberry dogwood, goldthread, brackenfern, Canada mayflower, American starflower, wild sarsaparilla, beaked hazelnut, yellow beadlily, wintergreen, bigleaf aster, blackberry, and wild strawberry.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation, seedling mortality, and the windthrow hazard. The use of equipment is restricted in the spring and in other excessively wet periods because of the seasonal high water table. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. Logging roads and landings that have a gravel base can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited. Adequate culverts are needed on graveled roads to maintain the natural drainage system.

The seedling mortality resulting from soil wetness can be reduced by planting vigorous nursery stock on the crest of cradle-knolls or on prepared ridges. A shallow rooting depth, which is caused by the high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

If drained, this soil is suited to cultivated crops, but only a few small areas are used as cropland. The soil is suited to pasture. Forage stands are difficult to establish and maintain because of the high water table and the low natural fertility. A cover of pasture plants is effective in controlling soil blowing. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates and rotation grazing help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the seasonal high water table. The roadbed can be

raised above the level of wetness by adding a coarse base material. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IVw. Based on red pine productivity, the woodland ordination symbol is 6W. The habitat type commonly is a vaccinium phase of TMC (TMC-V).

AxA—Augwood loamy sand, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on foot slopes of outwash-veneered moraines and drumlins. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are long and narrow or irregularly shaped and range from about 10 to 100 acres in size.

Typically, the surface layer is very dark gray loamy sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 33 inches thick. It is dark reddish brown, mottled loamy sand in the upper part and dark brown and strong brown, mottled sand in the lower part. The upper part of the substratum is brown, mottled sand about 19 inches thick. The lower part to a depth of about 80 inches is brown, mottled gravelly loamy sand. In some areas the surface layer is sand. In a few areas the lower part of the substratum is dominantly loamy and silty water-laid deposits. In places the sandy deposits have thin layers of gravelly sand or very gravelly sand, and in a few places they are less than 40 inches thick.

Included with this soil in mapping are small areas of very poorly drained soils in depressions, the somewhat poorly drained Au Gres soils in areas where the underlying loamy deposit is below a depth of 60 inches, and the moderately well drained Croswood and excessively drained Vilas soils on the higher parts of the landscape. Vilas soils are sandy throughout. Also included are areas where the surface soil is sandy loam or fine sandy loam, some areas where the sand fraction is fine or very fine, small very stony areas, and small ponds. Included areas make up less than 15 percent of the map unit.

Permeability is rapid in the upper layers of the Augwood soil and moderate in the loamy part of the substratum. Runoff is very slow. The available water capacity is low. The content of organic matter in the surface layer is moderate or moderately low. The potential for frost action is moderate. A perched seasonal high water table is at a depth of 0.5 foot to 2.0 feet. It limits the rooting depth of some plants.

Most areas are used as woodland. The timber stands are mostly red maple, red pine, paper birch, quaking aspen, and balsam fir, but yellow birch, eastern hemlock, eastern white pine, jack pine, and northern red oak are in most stands. The ground flora includes blueberry, bunchberry dogwood, goldthread, brackenfern, Canada mayflower, American starflower, wild sarsaparilla, beaked hazelnut, yellow beadlily, wintergreen, bigleaf aster, blackberry, and wild strawberry.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation, seedling mortality, and the windthrow hazard. The use of equipment is restricted in the spring and in other excessively wet periods because of the seasonal high water table. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. Logging roads and landings that have a gravel base can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited. Adequate culverts are needed on graveled roads to maintain the natural drainage system.

The seedling mortality resulting from soil wetness can be reduced by planting vigorous nursery stock on the crest of cradle-knolls or on prepared ridges. A shallow rooting depth, which is caused by the perched high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

If drained, this soil is suited to cultivated crops, but only a few small areas are used as cropland. The soil is suited to pasture. Forage stands are difficult to establish and maintain because of the high water table and the low natural fertility in the sandy deposits. A cover of pasture plants is effective in controlling soil blowing. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates and rotation grazing help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the seasonal high water table. The roadbed can be

raised above the level of wetness by adding a coarse base material. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IVw. Based on red pine productivity, the woodland ordination symbol is 7W. The habitat type commonly is a vaccinium phase of TMC (TMC-V).

CoA—Comstock silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on the lower parts of glacial lake basins. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are round or irregularly shaped. They generally range from 10 to 60 acres in size, but some are as large as 150 acres.

Typically, the surface layer is black silt loam about 2 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 9 inches thick. It is mottled in the lower part. The next layer is brown and reddish brown silt loam and reddish brown silty clay loam about 11 inches thick. It is mottled. The subsoil is about 35 inches thick. The upper part is reddish brown, mottled silty clay loam. The lower part is reddish brown, mottled silt loam that has thin layers of silty clay loam and fine sand. The substratum to a depth of about 60 inches also is reddish brown, mottled silt loam that has thin layers of silty clay loam and fine sand. In some areas the upper layers are loam. In places the substratum has thin layers of sand and gravel, and in a few places it is loamy glacial till.

Included with this soil in mapping are small areas of the moderately well drained Crystal Lake soils on the higher or more sloping parts of the landscape. Also included are small areas where the substratum is sand, areas where the surface soil is very fine sandy loam or fine sandy loam, narrow areas that have steep slopes, and small ponds and wet spots. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Comstock soil and moderately slow in the lower part. Runoff is slow. The available water capacity is high. The content of organic matter in the surface layer is moderate. The potential for frost action is high. The shrink-swell potential is moderate in the subsoil. The surface layer can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after rainfall. A perched seasonal high water table is at a depth of 1 to 3 feet. It limits the rooting depth of some plants.

Most areas are used as woodland. The timber stands are mostly red maple, balsam fir, and quaking aspen, but sugar maple, white ash, yellow birch, paper birch, and American hornbeam are in most stands. The ground flora includes Virginia waterleaf, ladyfern, rosy twistedstalk, beaked hazelnut, wild sarsaparilla, Canada mayflower, yellow beadlily, American starflower, bunchberry dogwood, sensitive fern, trout lily, dewberry, and cinnamon fern. Blueberry, horsetail, or goldthread are in areas where the seasonal high water table persists for longer periods.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation and the windthrow hazard. The use of equipment is restricted in the spring, late in fall, and during other excessively wet periods because of the seasonal high water table and low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Also, culverts are needed to maintain the natural drainage system. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited.

A shallow rooting depth, which is caused by the high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. The wetness in undrained areas limits yields and the kinds of crops that can be grown. Some undrained areas formerly used as cropland are now idle or have been planted to spruce trees. Field ditches, land smoothing, land grading, or a combination of these can remove excess surface water that accumulates during spring runoff and after heavy rains. Diversions on adjoining uplands or field ditches at the base of the adjoining uplands help to intercept and control runoff on this soil. Field ditches and tile drains can lower the water table. Because the soil is unstable and may cave, the sides of the ditches should be flattened and continuous tubing should be used when tile drains are installed. Filters are needed to keep fine particles of silt and sand from clogging the drains. Drainage tile may be displaced by frost action. This displacement can be prevented by

using continuous tubing or by installing the tile drains below the depth of freezing. The field ditches can be used as outlets for tile drains in areas where a suitable drainage outlet is not available.

Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching improve fertility, increase the infiltration rate and the movement of air and water through the soil, and help to prevent crusting and puddling of the surface layer.

This soil is suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain unless the soil is drained. Excess water during wet periods may damage the forage. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the low strength and the risk of frost damage. These limitations can be overcome by covering the soil with a coarse base material. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is 3W. The primary habitat type commonly is AViO or TMC. The secondary habitat type commonly is ATM or AH.

CpA—Comstock-Magnor silt loams, 0 to 3 percent slopes. These nearly level and gently sloping, somewhat poorly drained soils are on the lower parts of glacial lake basins on morainic landscapes. The surface of the land is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are round or irregularly shaped. They commonly range from about 5 to 80 acres in size, but some are several hundred acres. The areas generally are about 45 to 55 percent Comstock soil and 35 to 45 percent Magnor soil. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Comstock soil has a surface layer of very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and grayish brown, mottled silt loam about 9 inches thick. The next layer is brown and dark yellowish brown silt loam and dark yellowish brown silty clay loam about 10 inches thick. It is mottled. The subsoil is dark grayish brown, mottled silty clay loam and silt loam about 16 inches thick. The substratum to a depth of about 60 inches is brown and reddish brown, mottled silt loam that has thin layers of very fine sandy loam. In some areas the upper layers are loam. In places the substratum has thin layers of sand and gravel.

Typically, the Magnor soil has a surface layer of very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and grayish brown, mottled silt loam about 8 inches thick. The next layer is brown and yellowish brown, mottled silt loam about 15 inches thick. The subsoil is reddish brown, mottled, firm sandy loam about 15 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled, firm sandy loam. In some areas the upper layers are loam. In a few areas the upper silty deposits are more than 30 inches thick. In places the subsoil has a thin layer of sand and gravel. In a few places the lower part of the soil is friable.

Included with these soils in mapping are small areas of the moderately well drained Crystal Lake and Freeon soils on the higher or more sloping parts of the landscape. Also included are small areas where the surface soil is very fine sandy loam or fine sandy loam, narrow areas of steep slopes, and small ponds or wet spots. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Comstock and Magnor soils. It is moderately slow or slow in the loamy subsoil of the Magnor soil. It is moderately slow in the lower part of the Comstock soil and very slow in the lower part of the Magnor soil. Runoff is slow on both soils. The available water capacity is high. The content of organic matter in the surface layer is moderate in the Comstock soil and moderate or moderately low in the Magnor soil. The potential for frost action is high in both soils. The shrink-swell potential is moderate in the subsoil of the Comstock soil. The surface layer in both soils can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after rainfall. A perched seasonal high water table is at a depth of 1 to 3 feet in both soils. The rooting depth of some plants is limited by the seasonal high water table in both soils and the firm substratum in the Magnor soil.

Most areas are used as woodland. The timber stands on the Comstock soil are mostly red maple, balsam fir, and quaking aspen. The ground flora includes Virginia waterleaf, ladyfern, rosy twistedstalk, beaked hazelnut, wild sarsaparilla, Canada mayflower, yellow beadlily,

American starflower, bunchberry dogwood, sensitive fern, trout lily, dewberry, and cinnamon fern. Blueberry, horsetail, or goldthread are in areas where the seasonal high water table persists for longer periods. Red maple and sugar maple are the dominant species on the Magnor soil where blue cohosh, sweet cicely, and smooth yellow violet also are in the ground flora. American basswood and northern red oak also are in timber stands on the Magnor soil. Yellow birch, white ash, paper birch, and American hornbeam are in most stands on both soils.

These soils are suited to trees. The main concerns affecting woodland management are the equipment limitation and the windthrow hazard. The use of equipment is restricted in the spring, late in fall, and during other excessively wet periods because of the seasonal high water table and low soil strength. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soils are dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Also, culverts are needed to maintain the natural drainage system. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited.

A shallow rooting depth, which is caused by the high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, these soils are suited to corn and small grain and to grasses and legumes for hay and pasture. The wetness in undrained areas limits yields and the kinds of crops that can be grown. Some undrained areas formerly used as cropland are now idle or have been planted to spruce trees. The Magnor soil is difficult to drain because of the very slow internal drainage. Removing surface water helps to minimize the amount of water that infiltrates the soil. Field ditches, land smoothing, land grading, or a combination of these can be used on both soils to remove excess surface water that accumulates during spring runoff and after heavy rains. Diversions on adjoining uplands or field ditches at the base of the adjoining uplands help to intercept and control runoff on these soils.

Field ditches and tile drains can be used in areas of the Magnor soil to help remove the perched water table, except where the movement of water through the soil is too slow. They can be used in areas of the Comstock soil to lower the water table. The sides of ditches should be flattened in the Comstock soil because it is unstable and may cave, and continuous tubing should be used when tile drains are installed. Filters are needed in the Comstock soil to keep fine particles of silt and sand from clogging the drains. Drainage tile may be displaced by frost action in both soils. This displacement can be prevented by using continuous tubing or by installing the tile drains below the depth of freezing. The field ditches in both soils can be used as outlets for tile drains in areas where a suitable drainage outlet is not available.

Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching improve fertility, increase the movement of air and water through the soils, and help to prevent crusting and puddling of the surface layer.

These soils are suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain unless the soils are drained. Red clover, which is tolerant of soil wetness, commonly is seeded with alfalfa. This combination helps to ensure a dependable forage crop. Excess water during wet periods may damage the forage. Overgrazing or grazing when the soils are wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

These soils are generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

These soils are poorly suited to local roads because of the risk of frost damage on both soils and the low strength of the Comstock soil. These limitations can be overcome by adding a coarse base material. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is 3W. The primary habitat type commonly is AViO or TMC. The secondary habitat type commonly is ATM or AH.

CrB—Croswell loamy sand, 1 to 6 percent slopes. This nearly level and gently sloping or undulating, moderately well drained soil is on low flats and in swales and drainageways on the higher parts of the landscape. The landscape is pitted in places. Areas are elongated or irregularly shaped and range from about 10 to several hundred acres in size.

Typically, the surface layer is very dark gray loamy sand about 3 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 26 inches thick. It is dark reddish brown loamy sand in the upper part and dark brown and yellowish brown sand in the lower part. The lower 7 inches is mottled. The substratum to a depth of about 60 inches is yellowish red and brown, mottled sand. In some areas the surface layer is sand. In places the substratum is loamy sand. In a few places the soil has thin layers of gravelly sand or very gravelly sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Au Gres soils in swales and drainageways, the moderately well drained Croswood soils in areas where loamy till is at a depth of 40 to 60 inches, and the excessively drained Sayner and Vilas soils on the higher parts of the landscape. Sayner soils have a substratum of sand and gravel. Also included are areas where the soil has thin layers of loamy deposits, areas where the sand fraction is fine or very fine, narrow areas that have steep slopes, areas where the surface soil is sandy loam or fine sandy loam, and small ponds and wet spots. Included areas make up less than 15 percent of the map unit.

Permeability is rapid in the Croswell soil. Runoff is very slow. The available water capacity and natural fertility are low. The content of organic matter in the surface layer is low or moderately low. The surface layer can be easily tilled throughout a wide range in moisture content. A seasonal high water table is at a depth of 2.5 to 3.5 feet.

Most areas are used as woodland. The mature timber stands are mostly red maple, northern red oak, paper birch, eastern white pine, and red pine, but jack pine, balsam fir, and quaking aspen are in most stands. The ground flora includes blueberry, brackenfern, wintergreen, bigleaf aster, beaked hazelnut, grasses, barren strawberry, American starflower, wild sarsaparilla, blackberry, wild strawberry, and pipsissewa.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation and seedling mortality. Loose sand can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads and landings that are subject to the repeated use of heavy equipment can be stabilized with gravel. Seedling survival during dry periods can be improved by planting containerized seedlings or vigorous nursery stock when the soil is moist. After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means may be needed to control competing vegetation.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Some areas formerly used as cropland are now idle or have been planted to pine trees. Crop yields are generally limited because of the low available water capacity. Irrigation is necessary for dependable crop production. If cultivated, the soil is subject to soil blowing during dry periods. Field borders, field windbreaks, and vegetative row barriers help to control soil blowing. A conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface, cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing, improve fertility, and conserve the water available for plant growth. Additions of plant nutrients are needed because of the low natural fertility.

This soil is suited to pasture. It is droughty, however, and natural fertility is low. A cover of pasture plants is effective in controlling soil blowing. Overgrazing or grazing when the soil is dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during dry periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage. The response to additions of plant nutrients is limited, however, by the low available water content during dry periods.

This soil is poorly suited to septic tank absorption fields because of the rapid permeability and the seasonal high water table. These limitations can be overcome by constructing a mound of suitable filtering material. In some areas the effluent can be pumped to an absorption field established on higher, better suited soils.

This soil is suited to dwellings without basements and to local roads. It is only moderately suited to dwellings with basements because of the seasonal high water table, but basements can be constructed above the level of wetness. The soil may cave in if it is excavated.

The land capability classification is IVs. Based on red pine productivity, the woodland ordination symbol is 6A.

The habitat type commonly is ArQV or PMV.

CsB—Croswood loamy sand, 1 to 6 percent slopes. This nearly level and gently sloping, moderately well drained soil is on outwash-veneered moraines and drumlins. Areas are elongated or irregularly shaped and range from about 10 to 100 acres in size.

Typically, the surface layer is very dark gray loamy sand about 4 inches thick. The subsurface layer is dark grayish brown and grayish brown sand about 2 inches thick. The subsoil is about 25 inches thick. It is dark reddish brown loamy sand in the upper part and dark brown and strong brown sand in the lower part. The lower 9 inches is mottled. The upper 24 inches of the substratum is brown, mottled sand. Below this to a depth of about 60 inches is mostly brown, mottled gravelly loamy sand. In some areas the surface layer is sand. In a few areas the slope is 6 to 15 percent. In some places the lower part of the substratum is dominantly loamy and silty water-laid deposits. In places the sandy deposits have thin layers of gravelly sand or very gravelly sand, and in a few places they are less than 40 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Augwood soils in swales and drainageways, the moderately well drained Croswell soils in areas where the underlying loamy till is below a depth of 60 inches, and the excessively drained Vilas soils on small swells or knolls. Vilas soils are sandy throughout. Also included are areas where the surface soil is sandy loam or fine sandy loam, some areas where the sand fraction is fine or very fine, narrow areas that have steep slopes, small very stony areas, small ponds, and wet spots. Included areas make up less than 15 percent of the map unit.

Permeability is rapid in the upper layers of the Croswood soil and moderate in the loamy part of the substratum. Runoff is very slow. The available water capacity is low. The content of organic matter in the surface layer is moderately low or moderate. The surface layer can be easily tilled throughout a wide range in moisture content. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet.

Most areas are used as woodland. The mature timber stands are mostly red maple, northern red oak, paper birch, eastern white pine, and red pine, but balsam fir and quaking aspen are in most stands. The ground flora includes rosy twistedstalk, brackenfern, Canada mayflower, yellow beadlily, bigleaf aster, beaked hazelnut, grasses, barren strawberry, American starflower, wild sarsaparilla, blackberry, wild strawberry, and blueberry.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation and seedling mortality. Loose sand can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads and landings that are subject to the repeated use of heavy equipment can be stabilized with gravel. Seedling survival during dry periods can be improved by planting containerized seedlings or vigorous nursery stock when the soil is moist. After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means may be needed to control competing vegetation.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Some areas formerly used as cropland are now idle or have been planted to pine trees. Crop yields are generally limited because of the low available water capacity. Irrigation is necessary for dependable crop production. If cultivated, the soil is subject to soil blowing during dry periods. Field borders, field windbreaks, and vegetative row barriers help to control soil blowing. A conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface, cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing, improve fertility, and conserve the water available for plant growth. Additions of plant nutrients are needed because of the low natural fertility in the sandy deposits.

This soil is suited to pasture. It is droughty, however, and natural fertility is low in the sandy deposits. A cover of pasture plants is effective in controlling soil blowing. Overgrazing or grazing when the soil is dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during dry periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage. The response to additions of plant nutrients is limited, however, by the low available water content during dry periods.

This soil is poorly suited to septic tank absorption fields because of the rapid permeability in the sandy layers and the seasonal high water table. These limitations can be overcome by constructing a mound of suitable filtering material. In some areas the effluent can be pumped to an absorption field established on higher, better suited soils.

This soil is suited to dwellings without basements

and to local roads. It is only moderately suited to dwellings with basements because of the seasonal high water table, but basements can be constructed above the level of wetness. The sandy layers may cave in if they are excavated.

The land capability classification is IVs. Based on red pine productivity, the woodland ordination symbol is 7A. The habitat type commonly is PMV.

CyB—Crystal Lake silt loam, 1 to 6 percent slopes. This nearly level and gently sloping, moderately well drained soil is on the higher parts of glacial lake basins. Areas are round or irregularly shaped. They generally range from about 5 to 40 acres in size, but some are as large as 100 acres.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 1 inch thick. Below this is about 11 inches of dark yellowish brown silt loam. The subsoil is about 47 inches thick. The upper part is mostly reddish brown, mottled silty clay loam. The lower part is reddish brown, mottled silt loam that has thin layers of silty clay loam and fine sand. The substratum to a depth of about 60 inches is brown, mottled silt loam that has thin layers of silty clay loam and fine sand. In some areas the upper layers are loam. In some places the substratum has thin layers of sand and gravel, and in a few places it is loamy glacial till. In some areas the slope is 6 to 15 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Comstock soils in swales. Also included are small areas where the substratum is sand; areas where the surface soil is very fine sandy loam or fine sandy loam; narrow areas that have steep slopes; and small ponds, wet spots, and narrow gullies. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Crystal Lake soil and moderately slow in the lower part. Runoff is slow or medium. The available water capacity is high. The content of organic matter in the surface layer is moderate. The potential for frost action is high. The shrink-swell potential is moderate in the subsoil. The surface layer can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after rainfall. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch and black cherry are in most stands. The ground flora includes blue cohosh, sweet cicely, smooth yellow violet, ladyfern, Virginia waterleaf, stinging nettle, largeflowered bellwort, snow trillium, and bloodroot.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. Land smoothing in nearly level areas can prevent the crop damage caused by ponding. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, and help to prevent crusting and puddling of the surface layer. These measures also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

This soil is suited to pasture. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields because of the moderately slow permeability in the substratum and the seasonal high water table.

These limitations can be overcome by constructing a mound of suitable filtering material. In some areas the effluent can be pumped to an absorption field established on higher, better suited soils.

Because of the shrink-swell potential, this soil is only moderately suited to dwellings without basements. It is only moderately suited to dwellings with basements because of the seasonal high water table. The soil is poorly suited to local roads because of the low strength and the risk of frost damage. Excavating the subsoil and replacing it with coarse fill material helps to prevent the structural damage caused by shrinking and swelling. Basements can be constructed above the level of wetness. The limitations affecting local roads can be overcome by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is AViO or AH. The secondary habitat type commonly is ATM.

CyC—Crystal Lake silt loam, 6 to 15 percent slopes. This sloping, moderately well drained soil is on side slopes of glacial lake basins. Areas are long and narrow and range from about 5 to 20 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 1 inch thick. The next layer is dark yellowish brown and brown silt loam and reddish brown silty clay loam about 18 inches thick. It is mottled in the lower part. The subsoil is about 27 inches thick. The upper part is reddish brown, mottled silty clay loam. The lower part is brown, mottled silt loam that has thin layers of silty clay loam and fine sand. The substratum to a depth of about 60 inches also is brown, mottled silt loam that has thin layers of silty clay loam and fine sand. In some areas the upper layers are loam. In a few areas the slope is less than 6 percent. In places the substratum has thin layers of sand and gravel, and in a few places it is loamy glacial till.

Included with this soil in mapping are small areas of the somewhat poorly drained Comstock soils in drainageways. Also included are small areas where the substratum is sand, areas where the surface soil is very fine sandy loam or fine sandy loam, small areas where the slope is more than 15 percent, and some narrow gullies. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Crystal Lake soil and moderately slow in the lower part. Runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is moderate. The potential for frost action is high. The shrink-swell potential is moderate in the subsoil. The surface layer can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after rainfall. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch and black cherry are in most stands. The ground flora includes blue cohosh, sweet cicely, smooth yellow violet, ladyfern, Virginia waterleaf, stinging nettle, largeflowered bellwort, snow trillium, and bloodroot.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, help to prevent crusting and puddling of the surface layer, and help to prevent excessive water erosion.

This soil is suited to pasture. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the

growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields mainly because of the seasonal high water table and the moderately slow permeability in the substratum. Overcoming these limitations is difficult. A better site should be selected. In some areas the effluent can be pumped to an absorption field established on a better suited soil.

Because of the slope and the shrink-swell potential, this soil is only moderately suited to dwellings without basements. Because of the seasonal high water table and the slope, it is only moderately suited to dwellings with basements. The soil is poorly suited to local roads mainly because of low strength and the risk of frost damage. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. On sites for dwellings without basements, excavating the subsoil and replacing it with coarse fill material help to prevent the structural damage caused by shrinking and swelling. Also, basements can be constructed above the level of wetness. Interceptor tile may be needed to carry off the seepage from the higher adjacent slopes. The limitations affecting local roads can be overcome by replacing the upper part of the soil with coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is AViO or AH. The secondary habitat type commonly is ATM.

Fh—Fordum loam, 0 to 2 percent slopes. This nearly level, poorly drained and very poorly drained soil is on flood plains. It is frequently flooded and subject to ponding (figs. 10 and 11). The landscape is dissected by old stream channels in places. Areas are long and narrow and range from about 10 to 200 acres in size.

Typically, the surface layer is very dark brown, mottled loam about 4 inches thick. The subsurface layer is very dark grayish brown, mottled fine sandy loam about 5 inches thick. The upper part of the substratum is dark grayish brown, mottled sandy loam, dark gray loam, and very dark gray mucky loam that has thin layers of fine sand, very fine sand, or muck. Below this to a depth of about 60 inches is grayish brown, stratified very gravelly sand and sand. In places the upper part of the soil is muck. In some areas the lower part of the substratum is loamy or has thin layers of loamy deposits.

Included with this soil in mapping are small areas of somewhat poorly drained to excessively drained soils on the higher parts of the landscape. Also included are areas where the upper alluvial deposits are sandy; areas where hard bedrock is within a depth of 60 inches; and small marsh areas, fill areas, very stony areas, ponds, and springs. Included areas make up less than 15 percent of the map unit.

Permeability is moderate or moderately rapid in the upper part of the Fordum soil and rapid or very rapid in the lower part. Runoff is very slow or ponded. The available water capacity is moderate. The content of organic matter in the surface layer is high or very high. The potential for frost action is high. A seasonal high water table is above the surface or within a depth of 1 foot. The rooting depth of some plants is limited by the seasonal high water table and, in places, by the sand and gravel substratum.

Most areas of this soil support native wetland vegetation, such as tag alder, dogwood, willow, sedges, reeds, cattails, mosses, and wetland grasses and forbs. Some areas are used as woodland. The timber stands are variable but generally include silver maple, black ash, American elm, red maple, quaking aspen, eastern hemlock, and balsam fir. The ground flora includes mint and sedge.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation, seedling mortality, and the windthrow hazard. The high water table and frequent flooding restrict the use of equipment to periods in winter when the ground is frozen. The wetness and the flooding restrict the sites for landings to suitable adjacent soils or to small, included knolls of better drained soils. Trees generally are not planted on this soil because of the wetness. Reforestation is generally limited to natural regeneration. Seedling survival rates can be increased, however, by hand planting vigorous nursery stock on the crest of cradle-knolls.

Trees are shallow rooted because of the high water table. They can be uprooted by strong winds. The windthrow hazard can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can prevent or delay the natural regeneration of desirable tree species. Sites harvested by clearcutting commonly regenerate to tag alder. Special harvest methods may be needed to control the competing plants.

This soil is generally not suited to farming because of the wetness, the frequent flooding, and a severe hazard

Figure 10.—A flooded area of Fordum loam, 0 to 2 percent slopes. This photograph was taken on March 31, 1986.

of frost damage. Most areas cannot be drained by tile or open ditches because suitable drainage outlets generally are not available and because nearby streams control the level of the water table.

This soil is generally unsuited to septic tank absorption fields, dwellings, and local roads mainly because of the frequent flooding and ponding. Overcoming these hazards is difficult. A better site should be selected.

The land capability classification is VIw. Based on silver maple productivity, the woodland ordination symbol is 2W. A habitat type is not assigned.

FoB—Freeon silt loam, 2 to 6 percent slopes. This gently sloping or undulating, moderately well drained soil is on low swells or knolls, on the sides of drainageways and basins, on the crests and sides of drumlins, and on the higher parts of glacial lake basins on morainic landscapes. Areas are elongated or irregularly shaped. They generally range from about 5 to 60 acres in size, but some are as large as 200 acres.

Typically, the surface layer is very dark gray silt loam

Figure 11.—The same area of Fordum loam, 0 to 2 percent slopes, when it was not flooded. This photograph was taken on May 27, 1986.

about 1 inch thick. The subsurface layer is brown silt loam about 3 inches thick. The next layer is brown and dark yellowish brown silt loam and dark brown and brown, mottled sandy loam about 27 inches thick. The subsoil is reddish brown, mottled, firm sandy loam about 11 inches thick. The substratum to a depth of about 60 inches also is reddish brown, mottled, firm sandy loam. In some areas the upper layers are loam. In a few areas the slope is 6 to 15 percent. In places the subsoil has thin layers of silty deposits. In some areas the substratum is sandy clay loam or grus, and in other areas the substratum is friable.

Included with this soil in mapping are small areas of the somewhat poorly drained Magnor soils in swales and drainageways, the moderately well drained Newood soils in areas where the surface deposit is fine sandy loam, and some areas of well drained soils on the more sloping parts of the landscape. Also included are small ponds and wet spots in closed depressions, areas where hard bedrock is within a depth of 60 inches, narrow areas that have steep slopes, areas where the soil has a thin layer of sand and gravel, and small very

stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the silty upper part of the Freeon soil, slow or moderately slow in the loamy subsoil, and very slow in the substratum. Runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is moderate or moderately low. The potential for frost action is moderate. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. It tends to crust or puddle, however, after rainfall. A perched seasonal high water table is at a depth of 2.0 to 3.5 feet. The rooting depth of some plants is limited by the firm substratum.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch, northern red oak, and eastern hophornbeam are in most stands. The ground flora includes blue cohosh, sweet cicely, smooth yellow violet, ladyfern, Virginia waterleaf, hog peanut, mapleleaf viburnum, largeflowered bellwort, snow trillium, and bloodroot.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Some small areas are used as ginseng gardens. The soil is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, help to prevent crusting and puddling of the surface layer, and help to prevent excessive water erosion.

This soil is suited to pasture. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields because of the very slow permeability in the substratum and the seasonal high water table. These limitations can be overcome by constructing a mound of suitable filtering material.

This soil is only moderately suited to dwellings without basements and is poorly suited to dwellings with basements because of the seasonal high water table. Basements can be constructed above the level of wetness. The soil is only moderately suited to local roads because of the seasonal high water table and the risk of frost damage. These limitations can be overcome by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3D. The primary habitat type commonly is AViO or ATM. The secondary habitat type commonly is AH.

FoC—Freeon silt loam, 6 to 15 percent slopes. This sloping or rolling, moderately well drained soil is on swells, hills, and ridges; on the sides of drumlins and valleys; and on the sides of glacial lake basins on morainic landscapes. Areas are elongated or irregularly shaped and range from about 5 to 200 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is brown silt loam about 1 inch thick. The next layer is dark yellowish brown silt loam and brown and reddish brown sandy loam about 33 inches thick. It is mottled in the lower part. The subsoil is reddish brown, mottled, firm sandy loam about 9 inches thick. The substratum to a depth of about 60 inches also is reddish brown, mottled, firm sandy loam. In some areas the upper layers are loam.

In a few areas the slope is less than 6 percent. In some places the subsoil has thin layers of silty deposits. In other places the substratum is sandy clay loam or grus. In a few areas the substratum is friable.

Included with this soil in mapping are small areas of the somewhat poorly drained Magnor soils in swales and drainageways, the moderately well drained Newood soils in areas where the surface deposit is sandy loam, and some areas of well drained soils on the crests of hills and ridges. Also included are small ponds and wet spots in closed depressions, small areas where the slope is more than 15 percent, areas where hard bedrock is within a depth of 60 inches, areas where the soil has a thin layer of sand and gravel, and small very stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the silty upper part of the Freeon soil, slow or moderately slow in the loamy subsoil, and very slow in the substratum. Runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is moderate or moderately low. The potential for frost action is moderate. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. It tends to crust or puddle, however, after rainfall. A perched seasonal high water table is at a depth of 2.0 to 3.5 feet. The rooting depth of some plants is limited by the firm substratum.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch, northern red oak, and eastern hophornbeam are in most stands. The ground flora includes blue cohosh, sweet cicely, smooth yellow violet, ladyfern, Virginia waterleaf, hog peanut, mapleleaf viburnum, largeflowered bellwort, snow trillium, and bloodroot.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Some small areas are used as ginseng gardens. The soil is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, help to prevent crusting and puddling of the surface layer, and help to prevent excessive water erosion.

This soil is suited to pasture. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields mainly because of the seasonal high water table and the very slow permeability in the substratum. Overcoming these limitations is difficult. A better site should be selected. In some areas the effluent can be pumped to an absorption field established on a better suited soil.

Because of the slope and the seasonal high water table, this soil is only moderately suited to dwellings without basements. Because of the seasonal high water table, it is poorly suited to dwellings with basements. The soil is only moderately suited to local roads because of the risk of frost damage, the seasonal high water table, and the slope. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. Basements can be constructed above the level of wetness. Interceptor tile may be needed to carry off the seepage from the higher adjacent slopes. Frost action and wetness can be controlled on sites for local roads

by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIIe. Based on sugar maple productivity, the woodland ordination symbol is 3D. The primary habitat type commonly is AViO or ATM. The secondary habitat type commonly is AH.

FsB—Freeon-Sconsin silt loams, 2 to 6 percent slopes. These undulating, moderately well drained soils are on outwash-veneered moraines. The Freeon soil commonly is on the sides and foot slopes of low swells or knolls, and the Sconsin soil is on the shoulders and summits. Areas of these soils are irregularly shaped. They commonly range from about 5 to 100 acres in size, but some are as large as 500 acres. They generally are about 60 to 70 percent Freeon soil and 20 to 30 percent Sconsin soil. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Freeon soil has a surface layer of very dark gray silt loam about 4 inches thick. The next layer is dark yellowish brown, brown, and dark brown silt loam and reddish brown and brown loam about 25 inches thick. It is mottled in the lower part. The subsoil is reddish brown, mottled, firm gravelly sandy loam about 12 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled, firm sandy loam. In some areas the upper layers are loam. In a few areas the slope is 6 to 15 percent. In some places the subsoil is very cobbly, has thin layers of silty deposits, or has a thin layer of sand and gravel. In other places the lower part of the soil is friable.

Typically, the Sconsin soil has a surface layer of very dark grayish brown silt loam about 5 inches thick. The next layer is yellowish brown, brown, and dark yellowish brown silt loam about 18 inches thick. It is mottled in the lower part. The subsoil is about 16 inches thick. The upper part is dark yellowish brown, mottled loam, and the lower part is dark brown, mottled gravelly sandy loam. The substratum to a depth of about 60 inches is brown gravelly sand. In some areas the upper layers are loam. In a few areas the slope is 6 to 15 percent. In places the substratum is very cobbly, has thin layers of loamy deposits, or is at a depth of more than 45 inches.

Included with these soils in mapping are small areas of the somewhat poorly drained Magnor and Ossmer soils in swales and drainageways, the moderately well drained Newood and Padwet soils in areas where the surface deposit is fine sandy loam or sandy loam, and some small areas of the well drained Antigo soils on the crests of knolls. Also included are small, narrow areas that have steep slopes; small ponds and wet spots in closed depressions; and small gravel pits and very stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the silty upper part of the Freeon soil, slow or moderately slow in the loamy subsoil, and very slow in the substratum. It is moderate in the upper part of the Sconsin soil and rapid or very rapid in the lower part. Runoff is medium on both soils. The available water capacity is high in the Freeon soil and moderate in the Sconsin soil. The content of organic matter in the surface layer is moderate or moderately low in the Freeon soil and moderate in the Sconsin soil. The potential for frost action is moderate in both soils. The surface layer in both soils can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. It tends to crust or puddle, however, after rainfall. A perched seasonal high water table is at a depth of 2.0 to 3.5 feet in the Freeon soil. During some parts of the year, a mottled zone that is nearly saturated is at a depth of 2.5 to 3.5 feet in the Sconsin soil. The rooting depth of some plants is limited by the firm substratum in the Freeon soil and, in places, by the sand and gravel substratum in the Sconsin soil.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch is in most stands. The ground flora includes blue cohosh, sweet cicely, smooth yellow violet, ladyfern, Virginia waterleaf, largeflowered bellwort, snow trillium, and bloodroot. Northern red oak and eastern hophornbeam also are [illegible] timber stands on the Freeon soil where hog peanut and mapleleaf viburnum are in the ground flora. Black cherry is in stands on the Sconsin soil where four-lined honeysuckle is in the ground flora.

These soils are suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soils are dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

Subsequent control of invading species may be needed.

These soils are suited to corn and small grain and to grasses and legumes for hay and pasture. Some small areas are used as ginseng gardens. The soils are subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. The substratum in the Sconsin soil is droughty and may be difficult to vegetate if exposed during the construction of diversions or grassed waterways. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching improve fertility, help to prevent excessive water erosion, increase the infiltration rate and the movement of air and water through the soil, help to prevent crusting and puddling of the surface layer, and conserve the water available for plant growth in the Sconsin soil.

These soils are suited to pasture. A cover of pasture plants is effective in controlling water erosion. Overgrazing or grazing when the soils are wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, pasture renovation, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

These soils are poorly suited to septic tank absorption fields because of the seasonal high water table and the very slow permeability in the Freeon soil and because of the seasonal zone of near saturation and the rapid or very rapid permeability in the Sconsin soil. These limitations can be overcome by constructing a mound of suitable filtering material.

The Sconsin soil is suited to dwellings. The Freeon soil is only moderately suited to dwellings without basements and is poorly suited to dwellings with basements because of the seasonal high water table. Basements can be constructed above the level of wetness.

These soils are only moderately suited to local roads because of the risk of frost damage in both soils and the seasonal high water table in the Freeon soil. These limitations can be overcome by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3D for the Freeon soil and 3L for the Sconsin soil. The primary habitat type commonly is AViO or ATM. The secondary habitat type commonly is AH.

GoC—Goodman silt loam, 6 to 15 percent slopes. This sloping or rolling, well drained soil is on swells, hills, and ridges and on the sides of valleys and glacial lake basins on morainic landscapes. Areas are elongated or irregularly shaped. They commonly range from about 5 to 200 acres in size, but some are as large as 500 acres.

Typically, the surface layer is very dark gray silt loam about 5 inches thick. The subsurface layer is brown silt loam about 1 inch thick. The next layer is about 28 inches thick. It is dark brown and brown silt loam in the upper part and reddish brown and brown sandy loam in the lower part. The subsoil is reddish brown sandy loam about 16 inches thick. The substratum to a depth of about 60 inches also is reddish brown sandy loam. In some areas the upper layers are loam. In a few areas the slope is less than 6 percent. In some places the subsoil has thin layers of silty deposits. In other places the lower part of the soil is loamy sand or gravelly loamy sand, and in a few areas it has a thin layer of sand and gravel.

Included with this soil in mapping are small areas of the somewhat poorly drained Hatley soils in swales and drainageways, the moderately well drained Goodwit soils on the less sloping parts of the landscape, and the well drained Sarona soils in areas where the surface deposit is sandy loam. Also included are small ponds and wet spots in closed depressions, small areas where the slope is more than 15 percent, and small very stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the Goodman soil. Runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is moderate. The potential for frost action also is moderate. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. It tends to crust or puddle, however, after rainfall.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch, black cherry, and eastern hophornbeam are in most stands. The ground flora includes blue cohosh, sweet cicely, smooth yellow violet, ladyfern, Virginia waterleaf, largeflowered bellwort, snow trillium, bloodroot, and hog peanut.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of

low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. The soil is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, help to prevent crusting and puddling of the surface layer, and help to prevent excessive water erosion.

This soil is suited to pasture. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is only moderately suited to septic tank absorption fields and dwellings because of the slope. It is only moderately suited to local roads because of the slope and the risk of frost damage. Lateral seepage and the surfacing of septic tank effluent in downslope areas can be controlled by installing a trench absorption system on the contour. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. Frost damage to local roads can be controlled by replacing the upper part of the soil with coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is AViO. The secondary habitat type commonly is ATM.

GwB—Goodwit silt loam, 2 to 6 percent slopes. This gently sloping or undulating, moderately well drained soil is on low swells or knolls and on the higher parts of glacial lake basins on morainic landscapes. Areas are elongated or irregularly shaped. They commonly range from about 5 to 60 acres in size, but some are as large as 200 acres.

Typically, the surface layer is very dark gray silt loam about 2 inches thick. The subsurface layer is brown silt loam about 1 inch thick. The next layer is dark brown silt loam, brown and dark yellowish brown fine sandy loam, and brown and dark brown sandy loam about 33 inches thick. It is mottled in the lower part. The subsoil is dark brown, mottled sandy loam about 14 inches thick. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some areas the upper layers are loam. In a few areas the slope is 6 to 15 percent. In some places the subsoil has thin layers of silty deposits. In other places the lower part of the soil is loamy sand or gravelly loamy sand, and in a few areas it has a thin layer of sand and gravel.

Included with this soil in mapping are small areas of the somewhat poorly drained Hatley soils in swales and drainageways, the well drained Goodman soils on the more sloping parts of the landscape, and the moderately well drained Sarwet soils in areas where the surface deposit is sandy loam. Also included are narrow areas that have steep slopes, areas where the water table is not seasonally perched in the subsoil, small ponds and wet spots in closed depressions, and small very stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the Goodwit soil. Runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is moderate. The potential for frost action also is moderate. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. It tends to crust or puddle, however, after rainfall. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch, black cherry, and eastern hophornbeam are in most stands.

The ground flora includes blue cohosh, sweet cicely, smooth yellow violet, ladyfern, Virginia waterleaf, largeflowered bellwort, snow trillium, bloodroot, and hog peanut.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, help to prevent crusting and puddling of the surface layer, and help to prevent excessive water erosion.

This soil is suited to pasture. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields because of the perched seasonal high water table. This limitation can be overcome by constructing a mound of suitable filtering material.

This soil is suited to dwellings without basements. It is only moderately suited to dwellings with basements because of the seasonal high water table. Basements can be constructed above the level of wetness. The soil is only moderately suited to local roads because of the risk of frost damage. This limitation can be overcome by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is AViO. The secondary habitat type commonly is ATM.

HyB—Hatley silt loam, 0 to 4 percent slopes. This nearly level and gently sloping or undulating, somewhat poorly drained soil is in upland swales and drainageways and on low swells and knolls in low areas. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are elongated or irregularly shaped and commonly range from about 10 to 40 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is brown, mottled silt loam about 3 inches thick. The next layer is brown and dark brown, mottled silt loam and loam about 15 inches thick. The subsoil is reddish brown, mottled sandy loam about 25 inches thick. The substratum to a depth of about 60 inches is reddish brown sandy loam. In some areas the upper layers are loam. In a few areas the slope is 5 or 6 percent. In some places the subsoil has thin layers of silty deposits. In other places the lower part of the soil is loamy sand or gravelly loamy sand, and in a few areas it has a thin layer of sand and gravel. In some areas the upper silty deposits are more than 30 inches thick.

Included with this soil in mapping are small areas of the moderately well drained Goodwit and well drained Goodman soils on the higher or more sloping parts of the landscape, the very poorly drained Capitola soils in drainageways, and the somewhat poorly drained Moodig soils in areas where the surface deposit is sandy loam. Also included are small ponds and wet spots in closed depressions, narrow areas that have steep slopes, and small very stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the Hatley soil. Runoff is slow or medium. The available water capacity is high. The content of organic matter in the surface layer is moderate. The potential for frost action is high. The surface layer can be easily tilled throughout a wide

range in moisture content, except in the small included areas that are very stony. It tends to crust or puddle, however, after rainfall. A seasonal high water table is at a depth of 1 to 3 feet. It limits the rooting depth of some plants.

Most areas are used as woodland. The timber stands are mostly red maple and sugar maple, but yellow birch, white ash, and American basswood are in most stands. The ground flora includes Virginia waterleaf, blue cohosh, sweet cicely, smooth yellow violet, ladyfern, rosy twistedstalk, beaked hazelnut, wild sarsaparilla, Canada mayflower, yellow beadlily, and American starflower. Balsam fir and quaking aspen are in the timber stands on foot slopes where the seasonal high water table persists for longer periods. These wetter areas have sensitive fern, dewberry, or cinnamon fern in the ground flora.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation and the windthrow hazard. The use of equipment is restricted in the spring, late in fall, and during other excessively wet periods because of the seasonal high water table and low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Also, culverts are needed to maintain the natural drainage system. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited.

A shallow rooting depth, which is caused by the high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. The wetness in undrained areas limits yields and the kinds of crops that can be grown. Some undrained areas formerly used as cropland are now idle or have been planted to pine, fir, or spruce. Field ditches, land smoothing, land grading, or a combination of these can be used in the nearly level areas to remove excess surface water that accumulates during spring runoff and after heavy rains. Diversions on adjoining uplands or field ditches at the base of the adjoining uplands help to intercept and control runoff on this soil. Tile drains and field ditches can be used in the nearly level areas to lower the water table. The field ditches can be used as outlets for tile drains in areas where a suitable drainage outlet is not available. Drainage tile may be displaced by frost action. This displacement can be prevented by using continuous tubing or by installing the tile drains below the depth of freezing.

This soil is subject to water erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. In areas where contour farming, diversions, and terraces are used, establishing a slight grade towards grassed waterways helps to remove excess surface water. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching improve fertility, increase the movement of air and water through the soil, and help to prevent crusting and puddling of the surface layer. They also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

This soil is suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain, however, unless the soil is drained. Excess water during wet periods may damage the forage. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the risk of frost damage. This limitation can be overcome by covering the soil with a coarse base material. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is 3W. The primary habitat type commonly is AViO. The secondary habitat type commonly is ATM or TMC.

KwC—Keweenaw sandy loam, 6 to 15 percent slopes. This rolling, well drained soil is on swells, hills, and ridges. Areas commonly are irregularly shaped. They generally range from about 10 to 300 acres in size, but many are less than 40 acres.

Typically, the surface layer is dark brown sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 1 inch thick. The subsoil is about 25 inches thick. It is dark reddish brown and reddish brown sandy loam in the upper part and dark brown loamy sand in the lower part. Below this to a depth of about 60 inches is brown sand and reddish brown loamy sand and sandy loam. In some areas the surface layer is loamy sand or fine sandy loam. In a few areas the slope is less than 6 percent. In places the lower part of the soil is sand and gravel.

Included with this soil in mapping are small areas of moderately well drained and somewhat poorly drained soils on the lower parts of the landscape. Also included are small areas where the slope is more than 15 percent and small wet spots, ponds, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is moderate or moderately rapid in the Keweenaw soil. Runoff is medium. The available water capacity is low. The content of organic matter in the surface layer is moderately low. The surface layer can be easily tilled throughout a wide range in moisture content.

Most areas are used as woodland. The mature timber stands are mostly red maple, sugar maple, paper birch, and northern red oak, but American basswood, aspen, and white ash are in most stands (fig. 12). The ground flora includes brackenfern, bigleaf aster, beaked hazelnut, grasses, American starflower, wild sarsaparilla, Canada mayflower, spinulose woodfern, rosy twistedstalk, yellow beadlily, blueberry, and mapleleaf viburnum.

This soil is suited to trees. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping. After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Crop yields are limited by the low available water content during dry periods. The soil is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish.

If cultivated, this soil is subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve moisture. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing and water erosion, improve fertility, and conserve the water available for plant growth.

This soil is suited to pasture, but it is droughty during dry periods. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the soil is dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during dry periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer when the soil is moist helps to maintain a productive stand of forage.

This soil is only moderately suited to septic tank absorption fields, dwellings, and local roads because of the slope. Lateral seepage and the surfacing of septic tank effluent in downslope areas can be controlled by installing a trench absorption system on the contour. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. The soil may cave in if it is excavated.

The land capability classification is VIs. Based on sugar maple productivity, the woodland ordination symbol is 3A. The habitat type commonly is AVVb.

KwD—Keweenaw sandy loam, 15 to 35 percent slopes. This hilly to very steep, well drained soil is on hills and ridges. Areas are elongated or irregularly shaped and range from about 5 to 1,000 acres in size.

Typically, the surface layer is very dark gray sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is dark reddish brown and reddish brown sandy loam and dark brown loamy sand about 16 inches thick. Below this to a depth of about 99 inches is brown sand, brown and reddish brown loamy sand, and reddish brown and

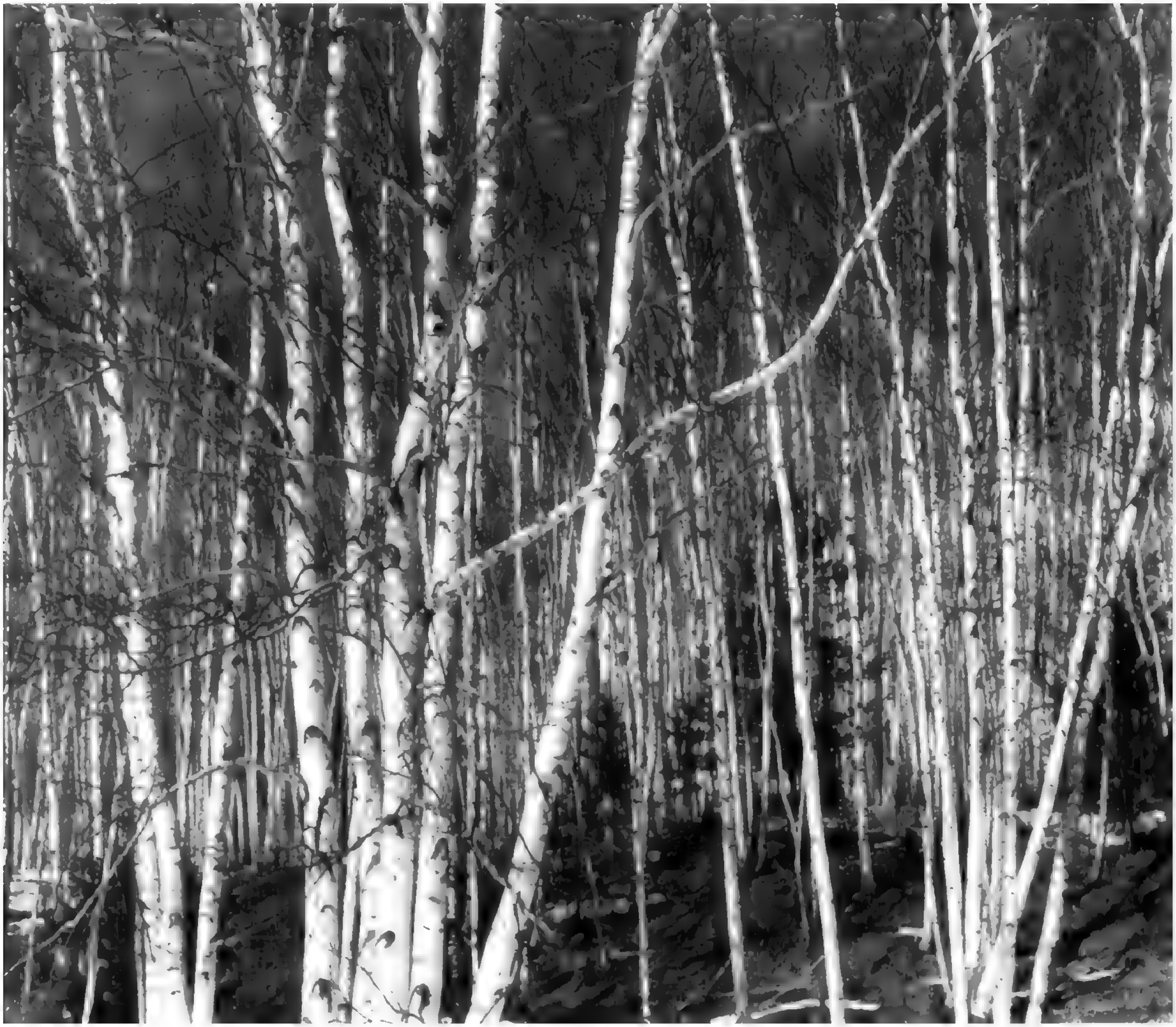

Figure 12.—A timber stand dominated by paper birch in an area of Keweenaw sandy loam, 6 to 15 percent slopes.

dark reddish brown sandy loam. In some areas the surface layer is loamy sand or fine sandy loam. In a few areas the slope is more than 35 percent. In places the lower part of the soil is sand and gravel.

Included with this soil in mapping are small areas of moderately well drained and somewhat poorly drained soils on the lower parts of the landscape. Also included are small areas where the slope is less than 15 percent and small wet spots, ponds, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is moderate or moderately rapid in the Keweenaw soil. Runoff is rapid. The available water capacity is low. The content of organic matter in the surface layer is moderately low.

Most areas are used as woodland. The mature timber stands are mostly red maple, sugar maple, paper birch, and northern red oak, but American basswood, aspen, and white ash are in most stands. The ground flora includes brackenfern, bigleaf aster, beaked hazelnut, grasses, American starflower, wild

sarsaparilla, Canada mayflower, spinulose woodfern, rosy twistedstalk, yellow beadlily, blueberry, and mapleleaf viburnum.

This soil is suited to trees. The main concerns affecting woodland management are the erosion hazard, the equipment limitation, and seedling mortality. Erosion results from the concentration of runoff on logging roads, skid trails, and landings. It can be minimized by logging, planting trees, and establishing roads and trails on the contour; yarding uphill by cable; and removing water by water bars, out-sloping road surfaces, and culverts. Drop structures may be needed to stabilize highly erodible areas. Seeding areas exposed by logging activities helps to establish a protective vegetative cover.

The slope limits the selection of sites for logging roads and landings. Establishing the roads on the contour helps to maintain a low grade. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping. Yarding the logs by cable and planting trees by hand may be necessary in areas where the slope limits the use of equipment.

Seedling survival during dry periods can be improved on the droughty southern exposures by planting containerized seedlings or vigorous nursery stock when the soil is moist. After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is generally not suited to cultivated crops because of the slope, the low available water capacity, and a severe hazard of erosion.

This soil is suited to pasture. Forage yields are limited because of the low available water content during dry periods. The soil should be managed for bluegrass in areas where the slope prevents the use of machinery. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the soil is dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation in areas where machinery can be used, and restricted use during dry periods help to keep the pasture in good condition. In areas where machinery can be used, clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer when the soil is moist helps to maintain a productive stand of forage.

Mainly because of the slope, this soil is generally unsuited to septic tank absorption fields and dwellings. Overcoming this limitation is difficult. A better site, such as a small included area of a better suited, less sloping soil, should be selected.

This soil is poorly suited to local roads because of the slope. Land shaping is needed to reduce the slope, or the roads can be built on the contour. The soil may cave in if it is excavated.

The land capability classification is VIIs. Based on sugar maple productivity, the woodland ordination symbol is 3R. The habitat type commonly is AVVb.

Lo—Loxley and Dawson peats, 0 to 1 percent slopes. These nearly level, very poorly drained soils are in kettles and basins. They are subject to ponding. They commonly have a hummocky surface. Areas are round, oblong, or irregularly shaped and range from about 5 to 700 acres in size. A single mapped area may be Loxley peat or Dawson peat or may contain both soils. Because the soils have similar behavior characteristics for present and anticipated uses in the survey area, mapping them separately was not considered practical.

Typically, the Loxley soil has an upper layer of light olive brown peat about 10 inches thick. The next layer is very dark grayish brown mucky peat about 10 inches thick. Below this to a depth of about 60 inches is dark reddish brown muck. In places the organic material is mostly mucky peat.

Typically, the Dawson soil has an upper layer of brown peat about 8 inches thick. The next layer is dark reddish brown and black muck about 32 inches thick. The substratum to a depth of about 60 inches is dark grayish brown sand. In places the organic material is mostly mucky peat, and in a few areas it is less than 16 inches thick.

Included with these soils in mapping are small areas of somewhat poorly drained to excessively drained soils on the higher parts of the landscape. Also included are some areas where the soils are less acid and support trees of merchantable size and quality; areas adjacent to lakes that are inundated throughout most of the year; and small marsh areas, fill areas, floating bogs, and ponds. Included areas make up less than 15 percent of the map unit.

Permeability is moderately rapid to moderately slow in the Loxley soil and in the organic part of the Dawson soil. It is rapid in the substratum of the Dawson soil. Runoff is very slow or ponded on both soils. The available water capacity is very high. The potential for frost action is high. A seasonal high water table is above the surface or within a depth of 1 foot. It limits the rooting depth of some plants.

Most areas of these soils support wetland vegetation, such as leatherleaf, Labrador tea, sphagnum moss, sedge, blueberry, cranberry, bog rosemary, pale laurel,

Figure 13.—A typical bog area of Loxley and Dawson peats, 0 to 1 percent slopes.

and wetland grasses. Some areas are wooded, but the soils are generally not suited to trees. They do not support trees of merchantable size or quality because of the extremely acid soil conditions (fig. 13). The timber stands are mostly widely spaced and stunted black spruce and tamarack.

These soils are generally not suited to farming because of the wetness, the extreme acidity, the low natural fertility, the poor trafficability, and a severe hazard of frost damage. Some small areas are used for the commercial production of cranberries. Most areas cannot be drained by tile or open ditches because suitable drainage outlets generally are not available.

Mainly because of subsidence, ponding, low strength, and the risk of frost damage, these soils are generally unsuited to septic tank absorption fields, dwellings, and local roads. Overcoming these limitations is difficult. A better site should be selected.

The land capability classification is VIIw for undrained areas. Based on black spruce productivity, the woodland ordination symbol is 2W. A habitat type is not assigned.

Lu—Lupton, Cathro, and Markey mucks, 0 to 1 percent slopes. These nearly level, very poorly drained soils are in drainageways and in kettles and basins.

They are subject to ponding. Areas are elongated or irregularly shaped and range from about 5 to several thousand acres in size. A single mapped area may contain one or more of the soils. Because the soils have similar behavior characteristics for present and anticipated uses in the survey area, mapping them separately was not considered practical or necessary.

Typically, the Lupton soil is dark reddish brown and black muck to a depth of about 60 inches. In places the organic material is mostly mucky peat.

Typically, the Cathro soil has an upper layer of black and dark reddish brown muck about 28 inches thick. The upper part of the substratum is dark gray, mottled loam. Below this to a depth of about 60 inches is dark grayish brown, mottled sandy loam. In some places the organic material is mostly mucky peat, and in a few other places it is less than 16 inches thick.

Typically, the Markey soil has an upper layer of black and dark brown muck about 36 inches thick. The substratum to a depth of about 60 inches is dark grayish brown sand. In places the organic material is mostly mucky peat, and in a few areas it is less than 16 inches thick.

Included with these soils in mapping are small areas of somewhat poorly drained to excessively drained soils on the higher parts of the landscape. Also included are some areas where the soils are extremely acid and do not support trees of merchantable size or quality; areas adjacent to lakes that are inundated throughout most of the year; and small springs, fill areas, marsh areas, and ponds. Included areas make up less than 15 percent of the map unit.

Permeability is moderately rapid to moderately slow in the organic part of the Lupton, Cathro, and Markey soils; moderate or moderately slow in the substratum of the Cathro soil; and rapid in the substratum of the Markey soil. Runoff is very slow or ponded on these soils. The available water capacity is very high. The potential for frost action is high. A seasonal high water table is above the surface or within a depth of 1 foot. It limits the rooting depth of some plants.

Most areas are used as woodland. Some areas support native wetland vegetation, such as tag alder, dogwood, willow, sedges, reeds, cattails, mosses, and wetland grasses and forbs (fig. 14). The timber stands are mostly northern whitecedar, black spruce, and balsam fir, but tamarack, red maple, American elm, eastern hemlock, and quaking aspen are in most stands. The ground flora includes sphagnum moss, horsetail, goldthread, bunchberry dogwood, and wood sorrel.

These soils are suited to trees. The main concerns affecting woodland management are the equipment limitation, seedling mortality, and the windthrow hazard. The high water table and the low strength of the organic material restrict the use of equipment to periods in winter when the ground is frozen. Sites for landings are limited to suitable adjacent soils or to small, included knolls of better drained mineral soils. Trees generally are not planted on these soils because of the wetness. Reforestation is generally limited to natural regeneration. Seedling survival rates can be increased, however, by hand planting vigorous nursery stock on the crest of cradle-knolls.

Trees are shallow rooted because of the high water table. They can be uprooted by strong winds (fig. 15). The windthrow hazard can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can prevent or delay the natural regeneration of desirable tree species. Sites harvested by clearcutting commonly regenerate to tag alder. Special harvest methods may be needed to control the competing plants.

These soils are generally not suited to farming because of the wetness, the low natural fertility, the poor trafficability, and a severe hazard of frost damage. Most areas cannot be drained by tile or open ditches because suitable drainage outlets generally are not available.

Mainly because of subsidence, ponding, low strength, and the risk of frost damage, these soils are generally unsuited to septic tank absorption fields, dwellings, and local roads. Overcoming these limitations is difficult. A better site should be selected.

The land capability classification is VIw for undrained areas. Based on balsam fir productivity, the woodland ordination symbol is 7W. A habitat type is not assigned.

MaB—Magnor silt loam, 0 to 4 percent slopes. This nearly level and gently sloping or undulating, somewhat poorly drained soil is on broad swells of ground moraines, on knolls within depressions, on the broad crests and foot slopes of drumlins, and in upland swales and drainageways. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are elongated or irregularly shaped and range from about 10 to several thousand acres in size.

Typically, the surface layer is very dark gray silt loam about 5 inches thick. The subsurface layer is dark grayish brown, mottled silt loam about 5 inches thick. The next layer is grayish brown and yellowish brown, mottled silt loam about 15 inches thick. The subsoil is reddish brown, mottled, firm sandy loam about 14 inches thick. The substratum to a depth of about 60 inches also is reddish brown, mottled, firm sandy loam. In some areas the upper layers are loam. In a few

Figure 14.—A typical area of Lupton, Cathro, and Markey mucks, 0 to 1 percent slopes. The native wetland vegetation is mostly tag alder and sedges.

areas the slope is 5 or 6 percent. In some places the subsoil has thin layers of silty deposits. In other places the substratum is sandy clay loam or grus. In a few areas the substratum is friable. In places the upper silty deposits are more than 30 inches thick.

Included with this soil in mapping are small areas of the very poorly drained Capitola soils in drainageways, the moderately well drained Freeon soils on the higher or more sloping parts of the landscape, the somewhat poorly drained Magroc soils in areas where bedrock is at a depth of 40 to 60 inches, and the somewhat poorly drained Pesabic soils in areas where the surface deposit is fine sandy loam. Also included are small ponds and wet spots in closed depressions, narrow areas that have steep slopes, areas where the soil has a thin layer of sand and gravel, and small very stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the silty upper part of the Magnor soil, slow or moderately slow in the loamy subsoil, and very slow in the substratum. Runoff is slow or medium. The available water capacity is high. The content of organic matter in the surface layer is moderate or moderately low. The potential for frost action is high. The surface layer can be easily tilled throughout a wide range in moisture content, except in

the small included areas that are very stony. It tends to crust or puddle, however, after rainfall. A perched seasonal high water table is at a depth of 1 to 3 feet. The rooting depth of some plants is limited by the perched seasonal high water table and the firm substratum.

Most areas are used as woodland. The timber stands are mostly red maple and sugar maple, but yellow birch, American basswood, white ash, northern red oak, and American hornbeam are in most stands. The ground flora includes Virginia waterleaf, blue cohosh, sweet cicely, smooth yellow violet, ladyfern, rosy twistedstalk, beaked hazelnut, wild sarsaparilla, Canada mayflower, yellow beadlily, American starflower, Virginia creeper, and trout lily. Balsam fir and quaking aspen are in the timber stands on foot slopes in areas where the perched seasonal high water table persists for longer periods. These wetter areas have sensitive fern, dewberry, or cinnamon fern in the ground flora.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation and the windthrow hazard. The use of

Figure 15.—Windthrow in an area of Lupton, Cathro, and Markey mucks, 0 to 1 percent slopes. Trees on these soils are shallow rooted because of a seasonal high water table.

equipment is restricted in the spring, late in fall, and during other excessively wet periods because of the seasonal high water table and low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Also, culverts are needed to maintain the natural drainage system. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited.

A shallow rooting depth, which is caused by the perched high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. The wetness in undrained areas limits yields and the kinds of crops that can be grown. Some undrained areas formerly used as cropland are now idle or have been planted to pine, fir, or spruce. Some small areas are used as ginseng gardens.

This soil is difficult to drain because of the very slow internal drainage, especially in the nearly level areas. Removing surface water helps to minimize the amount of water that infiltrates the soil. Field ditches, land smoothing, land grading, or a combination of these can be used in the nearly level areas to remove excess surface water that accumulates during spring runoff and after heavy rains. Diversions on adjoining uplands or field ditches at the base of the adjoining uplands help to intercept and control runoff on this soil. Tile drains and field ditches can be used in the nearly level areas to help remove the perched water table, except where the movement of water through the soil is too slow. The field ditches can be used as outlets for tile drains where a suitable drainage outlet is not available. Drainage tile may be displaced by frost action. This displacement can be prevented by using continuous tubing or by installing the tile drains below the depth of freezing.

This soil is subject to water erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Contour stripcropping is effective in controlling erosion in included areas where the slope is 4 to 6 percent and the slopes are long and smooth. Many areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. In areas where contour farming, contour stripcropping, diversions, and terraces are used, establishing a slight grade towards grassed waterways helps to remove excess surface water. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching improve fertility, increase the movement of air and water through the soil, and help to prevent crusting and puddling of the surface layer. They also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

This soil is suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain unless the soil is drained. Red clover, which is tolerant of soil wetness, commonly is seeded with alfalfa. This combination helps to ensure a dependable forage crop. Excess water during wet periods may damage the forage. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the risk of frost damage. This limitation can be overcome by covering the soil with a coarse base material. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is 3W. The primary habitat type commonly is AViO or AH. The secondary habitat type commonly is ATM or TMC.

MgB—Magnor-Ossmer silt loams, 0 to 4 percent slopes. These nearly level and gently sloping or undulating, somewhat poorly drained soils are on

outwash-veneered moraines. The Magnor soil commonly is on the summits and sides of knolls and swells. The Ossmer soil is on toe slopes and low flats where the slope is less than 3 percent. The surface of the land is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are irregularly shaped and range from about 10 to 500 acres in size. They generally are about 60 to 70 percent Magnor soil and 20 to 30 percent Ossmer soil. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Magnor soil has a surface layer of very dark gray silt loam about 3 inches thick. The subsurface layer is grayish brown, mottled silt loam about 7 inches thick. The next layer is pale brown and dark yellowish brown, mottled silt loam about 12 inches thick. The subsoil is about 33 inches thick. The upper part is dark yellowish brown, mottled loam; the next part is dark brown, mottled gravelly sandy loam; and the lower part is reddish brown, mottled, firm sandy loam. The substratum to a depth of about 60 inches is reddish brown, mottled, firm sandy loam. In some areas the upper layers are loam. In a few areas the upper silty deposits are more than 30 inches thick. In places the subsoil has thin layers of silty deposits or a thin layer of sand and gravel. In a few places the lower part of the soil is friable. In some areas the slope is 5 or 6 percent.

Typically, the Ossmer soil has a surface layer of very dark gray silt loam about 4 inches thick. The subsurface layer is pale brown, mottled silt loam about 5 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 9 inches thick. The subsoil is about 12 inches thick. It is dark brown, mottled sandy loam in the upper part and dark brown gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is strong brown very gravelly sand. In some areas the upper layers are loam. In a few areas the upper silty deposits are more than 30 inches thick. In places the substratum has thin layers of loamy deposits, and in a few areas it is at a depth of more than 45 inches.

Included with these soils in mapping are small areas of the moderately well drained Freeon and Sconsin soils on the higher or more sloping parts of the landscape, the somewhat poorly drained Pesabic and Worcester soils in areas where the surface deposit is fine sandy loam or sandy loam, and many small areas of very poorly drained mineral and organic soils in depressions. Also included are small areas where the lower part of the soils is very cobbly, narrow areas that have steep slopes, and small ponds and very stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Magnor and Ossmer soils. It is slow or moderately slow in the loamy subsoil of the Magnor soil. It is very slow in the lower part of the Magnor soil and rapid or very rapid in the lower part of the Ossmer soil. Runoff is slow or medium on the Magnor soil and slow on the Ossmer soil. The available water capacity is high in the Magnor soil and moderate in the Ossmer soil. The content of organic matter in the surface layer is moderate or moderately low in the Magnor soil and moderate in the Ossmer soil. The potential for frost action is high in both soils. The surface layer in both soils can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. It tends to crust or puddle, however, after rainfall. A seasonal high water table is at a depth of 1 to 3 feet in both soils. The water table is perched in the Magnor soil. The rooting depth of some plants is limited by the seasonal high water table of both soils, by the firm substratum in the Magnor soil, and, in places, by the sand and gravel substratum in the Ossmer soil.

Most areas are used as woodland. The timber stands on the Magnor soil are mostly red maple and sugar maple, but American basswood and northern red oak are in most stands. The ground flora includes Virginia waterleaf, blue cohosh, sweet cicely, smooth yellow violet, ladyfern, rosy twistedstalk, beaked hazelnut, wild sarsaparilla, Canada mayflower, yellow beadlily, American starflower, Virginia creeper, and trout lily. Red maple, balsam fir, and quaking aspen are the dominant species on the Ossmer soil in areas where bunchberry dogwood, sensitive fern, dewberry, and cinnamon fern also are in the ground flora. Yellow birch, white ash, paper birch, and American hornbeam are in most stands on both soils.

These soils are suited to trees. The main concerns affecting woodland management are the equipment limitation and the windthrow hazard. The use of equipment is restricted in the spring, late in fall, and during other excessively wet periods because of the seasonal high water table and low soil strength. Ruts form easily if wheeled skidders are used when the soils are wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soils are dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Also, culverts are needed to maintain the natural drainage system. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment. They also can be established on adjacent or included soils that are better suited.

A shallow rooting depth, which is caused by the high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness.

Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, these soils are suited to corn and small grain and to grasses and legumes for hay and pasture. The wetness in undrained areas limits yields and the kinds of crops that can be grown. Some undrained areas formerly used as cropland are now idle or have been planted to pine, fir, or spruce. Some small areas are used as ginseng gardens.

The Magnor soil is difficult to drain because of the very slow internal drainage, especially in the nearly level areas. Removing surface water helps to minimize the amount of water that infiltrates the soil. Field ditches, land smoothing, land grading, or a combination of these can be used in the nearly level areas of both soils to remove excess surface water that accumulates during spring runoff and after heavy rains. Diversions on adjoining uplands or field ditches at the base of the adjoining uplands help to intercept and control runoff on these soils.

Tile drains and field ditches can be used in the nearly level areas of the Magnor soil to help remove the perched water table, except where the movement of water through the soil is too slow. They can be used in the Ossmer soil to lower the water table. The sides of ditches should be flattened in areas of the Ossmer soil because the substratum is unstable and may cave, and continuous tubing should be used when tile drains are installed. Filters are needed in the Ossmer soil to keep the fine particles of sand in the substratum from clogging the drains. The field ditches in both soils can be used as outlets for tile drains in areas where a suitable drainage outlet is not available. Drainage tile may be displaced by frost action. This displacement can be prevented by using continuous tubing or by installing the tile drains below the depth of freezing.

The Magnor soil is subject to erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Many areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. In areas where contour farming, diversions, and terraces are used, establishing a slight grade towards grassed waterways helps to remove excess surface water. On both soils, cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching improve fertility, increase the movement of air and water through the soil, and help to prevent crusting and puddling of the surface layer. On the Magnor soil, these measures also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

These soils are suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain unless the soils are drained. Red clover, which is tolerant of soil wetness, commonly is seeded with alfalfa. This combination helps to ensure a dependable forage crop. Excess water during wet periods may damage the forage. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soils are wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

These soils are generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

These soils are poorly suited to local roads because of the risk of frost damage. This limitation can be overcome by covering the soil with a coarse base material. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is 3W. The primary habitat type commonly is AViO or TMC. The secondary habitat type commonly is ATM or AH.

MkB—Magroc silt loam, 0 to 4 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on foot slopes of ridges underlain by hard bedrock on morainic landscapes. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas commonly are elongated and range from about 10 to 60 acres in size.

Typically, the surface layer is very dark gray silt loam about 4 inches thick. The subsurface layer is grayish brown, mottled silt loam about 7 inches thick. The next layer is brown and dark yellowish brown silt loam and gravelly silt loam about 18 inches thick. It is mottled. The subsoil is reddish brown, mottled gravelly sandy

loam about 13 inches thick. Fractured metamorphic bedrock is at a depth of about 42 inches. In a few areas the upper layers are loam. In other areas the upper silty deposits are more than 30 inches thick. In places, the lower part of the soil is grus or it has a thin layer of sand and gravel. In a few areas the slope is 5 or 6 percent.

Included with this soil in mapping are small areas of very poorly drained soils in drainageways, the somewhat poorly drained Magnor soils in areas where the bedrock is below a depth of 60 inches, and the well drained Mequithy soils and moderately well drained soils on the higher parts of the landscape. Mequithy soils are underlain by bedrock at a depth of 20 to 40 inches. Also included are small areas where the surface soil is very fine sandy loam or fine sandy loam, small areas of rock outcrop, and small very stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the Magroc soil. Runoff is slow or medium. The available water capacity is moderate. The content of organic matter in the surface layer is moderate or moderately low. The potential for frost action is high. A seasonal high water table is at a depth of 1 to 3 feet. The rooting depth of most plants is limited by the seasonal high water table and by the bedrock.

Most areas are used as woodland. The mature timber stands are mostly red maple and sugar maple, but yellow birch, American basswood, white ash, northern red oak, and American hornbeam are in most stands. The ground flora includes Virginia waterleaf, blue cohosh, sweet cicely, smooth yellow violet, ladyfern, rosy twistedstalk, beaked hazelnut, wild sarsaparilla, Canada mayflower, yellow beadlily, American starflower, Virginia creeper, and trout lily. Balsam fir and quaking aspen are in the timber stands on foot slopes in areas where the seasonal high water table persists for longer periods. These wetter areas have sensitive fern, dewberry, or cinnamon fern in the ground flora.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation and the windthrow hazard. The use of equipment is restricted in the spring, late in fall, and during other excessively wet periods because of the seasonal high water table and low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Also, culverts are needed to maintain the natural drainage system. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited. Yarding the logs by cable and planting trees by hand may be necessary in some areas where stones or rock outcrops limit the use of equipment.

A shallow rooting depth, which is caused by the high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, this soil is suited to cultivated crops, but only a few small areas are used as cropland. The soil is suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain unless the soil is drained. Excess water during wet periods may damage the forage. A cover of pasture plants is effective in controlling erosion in areas where the slope is more than 2 percent. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

Mainly because of the seasonal high water table, this soil is generally unsuited to septic tank absorption fields and dwellings. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the risk of frost damage. This limitation can be overcome by covering the soil with a coarse base material. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is 3W. The primary habitat type commonly is AViO or AH. The secondary habitat type commonly is ATM or TMC.

MoB—Mequithy silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on the summits and shoulders of ridges underlain by hard bedrock on morainic landscapes. Areas are elongated or irregularly

shaped and range from about 10 to 80 acres in size.

Typically, the surface layer is very dark gray silt loam about 4 inches thick. The next layer is dark brown, brown, and dark yellowish brown silt loam about 19 inches thick. The subsoil is dark brown sandy loam and strong brown cobbly sandy loam about 13 inches thick. Fractured igneous and metamorphic bedrock is at a depth of about 36 inches. In some areas the surface layer is loam. In a few areas the slope is 6 to 15 percent. In places, the lower part of the subsoil is grus or it has a thin layer of sand and gravel.

Included with this soil in mapping are small areas of Magroc soils and other somewhat poorly drained soils in drainageways and areas of Freeon soils and other moderately well drained soils on the lower parts of the landscape. Freeon soils do not have bedrock within a depth of 60 inches. Magroc soils have bedrock at a depth of 40 to 60 inches. Also included are small areas where bedrock is within a depth of 20 inches; small areas of bedrock outcrop or escarpment; areas where the surface soil is very fine sandy loam or fine sandy loam; narrow areas that have steep slopes; and small wet spots, very stony areas, and quarries. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the Mequithy soil. Runoff is medium. The available water capacity is moderate or low. The content of organic matter in the surface layer is moderate. The potential for frost action is moderate. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas of bedrock outcrop or escarpment and the small very stony areas. It tends to crust or puddle, however, after rainfall. The rooting depth of most plants is limited by the underlying bedrock.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch, black cherry, eastern hophornbeam, and northern red oak are in most stands. The ground flora includes blue cohosh, Virginia waterleaf, snow trillium, largeflowered bellwort, bloodroot, hog peanut, mapleleaf viburnum, sweet cicely, smooth yellow violet, and ladyfern.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment. Yarding the logs by cable and planting trees by hand may be necessary in some areas where stones or rock outcrops limit the use of equipment. Excavation of deep cuts and road ditches is restricted by the underlying bedrock.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Crop yields are limited by the shallow root zone. Rock outcrops or stones restrict tilling and harvesting in places. The soil is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. The moderate depth to bedrock can limit the construction of diversions, grassed waterways, and terraces. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, help to prevent crusting and puddling of the surface layer, conserve the water available for plant growth, and help to prevent excessive water erosion.

This soil is suited to pasture. It can be managed for bluegrass in areas where rock outcrops or stones prevent the use of machinery. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields because of the thin layer of soil over hard bedrock. This limitation can be overcome by constructing a mound of suitable filtering material. In some places the absorption field can be established on better suited included or adjacent soils where the layer of soil is more than 5 feet thick.

Mainly because of the thin layer of soil over hard bedrock, this soil is only moderately suited to dwellings without basements and is poorly suited to dwellings with basements. Sites for dwellings without basements can be raised by adding fill material. In some areas large stones or rock outcrops limit the use of machinery.

This soil is only moderately suited to local roads because of the thin layer of soil over hard bedrock and the risk of frost damage. Frost action can be controlled by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts. Additions of fill material may be needed to raise the roadbed above the level of bedrock. Excavations for road ditches and other cuts may be limited by the underlying bedrock. In some areas stones or rock outcrops limit the use of machinery.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is AViO or ATM. The secondary habitat type commonly is AH.

MoC—Mequithy silt loam, 6 to 15 percent slopes. This sloping, well drained soil is on the sides of ridges underlain by hard bedrock on morainic landscapes. Areas are elongated and range from about 10 to 400 acres in size.

Typically, the surface layer is very dark gray silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 1 inch thick. The next layer is about 23 inches thick. It is dark brown silt loam and loam in the upper part and brown and dark yellowish brown silt loam in the lower part. The subsoil is dark brown cobbly loam about 10 inches thick. Fractured igneous and metamorphic bedrock is at a depth of about 38 inches. In some areas the surface layer is loam. In a few areas the slope is less than 6 percent. In places, the lower part of the subsoil is grus or it has a thin layer of sand and gravel.

Included with this soil in mapping are small areas of Magroc and other somewhat poorly drained soils in drainageways and areas of Freeon and other moderately well drained soils on foot slopes. Freeon soils do not have bedrock within a depth of 60 inches. Magroc soils have bedrock at a depth of 40 to 60 inches. Also included are small areas where bedrock is within a depth of 20 inches, areas of bedrock outcrop or escarpment, areas where the surface soil is very fine sandy loam or fine sandy loam, small areas where the slope is more than 15 percent, and small very stony areas and quarries. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the Mequithy soil. Runoff is medium. The available water capacity is moderate or low. The content of organic matter in the surface layer is moderate. The potential for frost action also is moderate. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas of bedrock outcrop or escarpment and the small very stony areas. It tends to crust or puddle, however, after rainfall. The rooting depth of most plants is limited by the underlying bedrock.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but northern red oak, black cherry, yellow birch, and eastern hophornbeam are in most stands. The ground flora includes blue cohosh, sweet cicely, smooth yellow violet, ladyfern, Virginia waterleaf, largeflowered bellwort, snow trillium, bloodroot, mapleleaf viburnum, and hog peanut.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping. Yarding the logs by cable and planting trees by hand may be necessary in some areas where stones or rock outcrops limit the use of equipment (fig. 16). Excavation of deep cuts and road ditches is restricted by the underlying bedrock.

After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Crop yields are limited by the shallow root zone. Rock outcrop or stones restrict tilling and harvesting in places. The soil is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. The moderate

Figure 16.—Rock outcrops in an area of Mequithy silt loam, 6 to 15 percent slopes. These small areas of protruding bedrock can limit the use of forestry equipment.

depth to bedrock may limit the construction of diversions, grassed waterways, and terraces. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, help to prevent crusting and puddling of the surface layer, conserve the water available for plant growth, and help to prevent excessive water erosion.

This soil is suited to pasture. It can be managed for bluegrass in areas where rock outcrops or stones prevent the use of machinery. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in depletion of the plant cover, surface compaction, and the growth of

undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields mainly because of the thin layer of soil over hard bedrock. Overcoming this limitation is difficult. A better site should be selected. In some areas the absorption field can be established on better suited included or adjacent soils where the layer of soil is more than 5 feet in thickness.

This soil is only moderately suited to dwellings without basements mainly because of the slope and the thin layer of soil over hard bedrock. It is poorly suited to dwellings with basements because of the thin layer of soil over hard bedrock. Dwellings can be designed so that they conform to the natural slope of the land. Level sites for dwellings without basements can be constructed by adding coarse textured fill material to the downslope area. In some areas large stones or rock outcrops can limit the use of machinery.

This soil is only moderately suited to local roads because of the thin layer of soil over hard bedrock, the slope, and the risk of frost damage. Frost action can be controlled by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts. Excavation for road ditches and other cuts is restricted by the underlying bedrock. Constructing the roads on the contour minimizes the amount of cutting required to shape the roadway. Additions of fill material may be needed to raise the roadbed above the level of bedrock. In some areas stones or rock outcrops limit the use of machinery.

The land capability classification is IIIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is AViO or ATM. The secondary habitat type commonly is AH.

Ms—Minocqua and Capitola mucks, 0 to 2 percent slopes. These nearly level, very poorly drained soils are in kettles, basins, drainageways, and upland swales. They are subject to ponding. Areas are long and narrow or irregularly shaped and range from about 5 to 200 acres in size. A single mapped area may be made up of only one of the soils, or it may contain both soils. Because the soils have similar behavior characteristics for present and anticipated uses in the survey area, mapping them separately was not considered practical or necessary.

Typically, the Minocqua soil has a surface layer of black muck about 4 inches thick. The subsurface layer is very dark gray silt loam about 1 inch thick. The subsoil is about 32 inches thick. It is gray, greenish gray, and dark greenish gray, mottled silt loam in the upper part; greenish gray, mottled loam in the next part; and dark gray, mottled gravelly sandy loam in the lower part. The substratum to a depth of about 60 inches is dark grayish brown very gravelly sand. In places the surface layer is mostly mineral soil. In a few places the organic part of the surface layer is more than 6 inches thick. In some areas the substratum is at a depth of more than 40 inches, and in a few areas it has thin layers of loamy deposits. In a few places the upper part of the soil is loamy alluvium.

Typically, the Capitola soil has a surface layer of black muck about 5 inches thick. The subsurface layer is very dark gray, mottled silt loam about 2 inches thick. The subsoil is about 26 inches thick. It is gray and dark grayish brown, mottled silt loam in the upper part and brown, mottled sandy loam in the lower part. The substratum to a depth of about 60 inches is dark brown, mottled sandy loam. In places the surface layer is mostly mineral soil. In a few places the organic part of the surface layer is more than 6 inches thick. In some areas the substratum and the lower part of the subsoil are sandy clay loam, and in a few areas they are firm.

Included with these soils in mapping are small areas of somewhat poorly drained to excessively drained soils on the higher parts of the landscape, areas where hard bedrock is within a depth of 60 inches, and areas where the deposits below the surface layer are mostly sandy. Also included are small ponds, springs, marsh areas, and very stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Minocqua soil, moderately rapid or rapid in the lower part of the subsoil, and rapid or very rapid in the substratum. It is moderate or moderately slow in the upper part of the Capitola soil and moderately slow in the lower part. Runoff is very slow or ponded on both soils. The available water capacity is moderate in the Minocqua soil and high in the Capitola soil. The potential for frost action is high in both soils. A seasonal high water table is above the surface or within a depth of 1 foot in both soils. It limits the rooting depth of some plants. In places the rooting depth also is limited by a sand and gravel substratum in the Minocqua soil and by a firm substratum in the Capitola soil.

Most areas are used as woodland. Some areas support native wetland vegetation, such as tag alder, dogwood, willow, sedges, reeds, cattails, mosses, and wetland grasses and forbs. Composition of the timber stands is variable. Some are mostly black ash with

sedge and mint in the ground flora. Other stands are mostly northern whitecedar, black spruce, balsam fir, and tamarack. Sphagnum moss, naked miterwort, and northern twinflower are in the ground flora. Red maple, American elm, eastern hemlock, and quaking aspen are in most stands.

These soils are suited to trees. The main concerns affecting woodland management are the equipment limitation, seedling mortality, and the windthrow hazard. The high water table restricts the use of equipment to periods in winter when the ground is frozen. Wetness limits the sites for landings to suitable adjacent soils or to small, included knolls of better drained soils. Trees generally are not planted on these soils because of the wetness. Reforestation is generally limited to natural regeneration. Seedling survival rates can be increased, however, by hand planting vigorous nursery stock on the crest of cradle-knolls.

Trees are shallow rooted because of the high water table. They can be uprooted by strong winds. The windthrow hazard can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can prevent or delay the natural regeneration of desirable tree species. Sites harvested by clearcutting commonly regenerate to tag alder. Special harvest methods may be needed to control the competing plants.

These soils are generally not suited to farming because of the wetness, the poor trafficability, and a severe hazard of frost damage. Most areas cannot be drained by tile or open ditches because suitable drainage outlets generally are not available.

Mainly because of the ponding, these soils are generally unsuited to septic tank absorption fields and dwellings. Overcoming this limitation is difficult. A better site should be selected.

These soils are poorly suited to local roads because of the ponding and the risk of frost damage. These limitations can be overcome by adding coarse base material to raise the roadbed above the level of wetness and by installing a good drainage system of adequate side ditches and culverts.

The land capability classification is VIw for undrained areas. Based on balsam fir productivity, the woodland ordination symbol is 7W. A habitat type is not assigned.

MxB—Moodig sandy loam, 0 to 4 percent slopes. This nearly level and gently sloping or undulating, somewhat poorly drained soil is on small swells and knolls in low areas, on the broad crests and foot slopes of drumlins, and in upland swales and drainageways. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are mostly elongated and range from about 10 to 200 acres in size.

Typically, the surface layer is very dark gray sandy loam about 3 inches thick. The subsurface layer is brown gravelly sandy loam about 2 inches thick. The upper part of the subsoil is dark brown, mostly mottled sandy loam and gravelly sandy loam about 17 inches thick. The next layer is about 31 inches of mostly brown, mottled sandy loam and gravelly sandy loam and some brown, mottled loamy sand and gravelly loamy sand. The lower part of the subsoil is brown, mottled gravelly sandy loam about 20 inches thick. The substratum to a depth of about 95 inches is brown gravelly sandy loam. In some areas the surface layer is loam or fine sandy loam. In places the lower part of the soil has a thin layer of sand and gravel. In a few places the slope is 5 or 6 percent.

Included with this soil in mapping are small areas of the very poorly drained Capitola soils in drainageways, the somewhat poorly drained Hatley soils in areas where the surface deposit is silt loam, and the moderately well drained Sarwet and well drained Sarona soils on the higher parts of the landscape. Also included are many small areas of very poorly drained organic soils in depressions, some areas where the surface soil is sandy and droughty, narrow areas that have steep slopes, small areas where the subsoil has thin layers of silty deposits, and small very stony areas and ponds. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the Moodig soil. Runoff is slow. The available water capacity is moderate. The content of organic matter in the surface layer also is moderate. The potential for frost action is high. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. A perched seasonal high water table is at a depth of 0.5 foot to 2.0 feet. It limits the rooting depth of some plants.

Most areas are used as woodland. The timber stands are mostly red maple and sugar maple, but yellow birch, eastern hemlock, and paper birch are in most stands. The ground flora includes bunchberry dogwood, goldthread, smooth yellow violet, ladyfern, Canada mayflower, American starflower, rosy twistedstalk, mapleleaf viburnum, wild sarsaparilla, beaked hazelnut, and yellow beadlily. Red maple, balsam fir, and quaking aspen are the dominant species on foot slopes where the perched seasonal high water table persists for longer periods. These wetter areas have wood sorrel, sensitive fern, or cinnamon fern in the ground flora.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation and the windthrow hazard. The use of

equipment is restricted in the spring and in other excessively wet periods because of the seasonal high water table and low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. Logging roads and landings that have a gravel base can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited. Adequate culverts are needed on graveled roads to maintain the natural drainage system.

A shallow rooting depth, which is caused by the perched high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. The high water table in undrained areas limits yields and the kinds of crops that can be grown. Field ditches and tile drains can be used in the nearly level areas to help remove the perched water table. The field ditches can be used as outlets for tile drains where a suitable drainage outlet is not available. Drainage tile may be displaced by frost action. This displacement can be prevented by using continuous tubing or by installing the tile drains below the depth of freezing.

This soil is subject to water erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas.

If drained and cultivated, this soil is subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure improve fertility and help to control soil blowing. These measures also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

This soil is suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain unless the soil is drained. Excess water during wet periods may damage the forage. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, and pasture renovation help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

Mainly because of the seasonal high water table, this soil is generally unsuited to septic tank absorption fields and dwellings. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the seasonal high water table and the risk of frost damage. These limitations can be overcome by covering the soil with a coarse base material. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is 3W. The primary habitat type commonly is TMC. The secondary habitat type commonly is ATM.

NeC—Newood sandy loam, 6 to 15 percent slopes. This sloping or rolling, moderately well drained soil is on swells, hills, and ridges and on the sides of drumlins and valleys. Areas are elongated or irregularly shaped and range from about 10 to 1,000 acres in size.

Typically, the surface layer is very dark gray sandy loam about 4 inches thick. The subsurface layer is brown gravelly sandy loam about 1 inch thick. The next layer is dark brown, brown, and reddish brown gravelly sandy loam about 32 inches thick. The subsoil is reddish brown, mottled, firm gravelly sandy loam and sandy loam about 21 inches thick. The substratum to a depth of about 60 inches is reddish brown, firm sandy loam. In some areas the surface layer is very fine sandy loam or fine sandy loam. In a few areas the slope is less than 6 percent. In places the lower part of the soil is friable, and in some places it has a thin layer of sand and gravel.

Included with this soil in mapping are small areas of the moderately well drained Freeon soils in areas where the surface deposit is silty, the somewhat poorly drained Pesabic soils in swales and drainageways, and some areas of the well drained Newot soils on the sides of hills and ridges. Also included are many small areas of very poorly drained organic soils in depressions, small areas where the slope is more than 15 percent,

areas where the surface soil is loam, and small very stony areas and ponds. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Newood soil, slow in the lower part of the subsoil, and very slow in the substratum. Runoff is medium. The available water capacity is moderate. The content of organic matter in the surface layer is moderately low or moderate. The potential for frost action is moderate. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet. The rooting depth of some plants is limited by the firm substratum.

Most areas are used as woodland. The mature timber stands are mostly red maple, sugar maple, eastern hemlock, paper birch, and northern red oak, but white ash, aspen, yellow birch, and eastern hophornbeam are in most stands. The ground flora includes beaked hazelnut, wild sarsaparilla, rosy twistedstalk, Canada mayflower, grasses, partridgeberry, yellow beadlily, and mapleleaf viburnum. American starflower, bigleaf aster, brackenfern, wintergreen, and blueberry are in the ground flora in formerly burned areas.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping.

After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish.

If cultivated, this soil is subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve moisture. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing and water erosion, improve fertility, and conserve the water available for plant growth.

This soil is suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, pasture renovation, and rotation grazing help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields mainly because of the seasonal high water table and the very slow permeability in the substratum. Overcoming these limitations is difficult. A better site should be selected. In some areas the effluent can be pumped to an absorption field established on a better suited soil.

Because of the slope, this soil is only moderately suited to dwellings without basements. Because of the seasonal high water table and the slope, it is moderately suited to dwellings with basements. The soil is only moderately suited to local roads because of the slope and the risk of frost damage. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. Basements can be constructed above the level of wetness. Interceptor tile may be needed to carry off the seepage from the higher adjacent slopes. On sites for local roads, frost action can be controlled by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIIe. Based on sugar maple productivity, the woodland ordination symbol is 3D. The habitat type commonly is ATM.

NoB—Newood fine sandy loam, 2 to 6 percent slopes. This gently sloping or undulating, moderately well drained soil is on small knolls and on the crests and sides of drumlins. Areas are elongated or irregularly shaped and range from about 5 to 100 acres in size.

Typically, the surface layer is very dark gray fine sandy loam about 4 inches thick. The subsurface layer is brown loam about 1 inch thick. The subsoil is dark brown sandy loam and fine sandy loam about 11 inches thick. The next layer is brown fine sandy loam and

brown and reddish brown, mottled gravelly sandy loam and sandy loam about 29 inches thick. It is firm in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled, firm sandy loam. In some areas the surface layer is sandy loam or very fine sandy loam. In other areas the slope is 6 to 15 percent. In a few areas the subsoil has thin layers of silty deposits. In some places the lower part of the soil is friable, and in other places it has a thin layer of sand and gravel.

Included with this soil in mapping are small areas of the moderately well drained Freeon soils in areas where the surface deposit is silty, the somewhat poorly drained Pesabic soils in swales and drainageways, and some areas of the well drained Newot soils on the more sloping parts of the landscape. Also included are many small areas of very poorly drained organic soils in depressions, narrow areas that have steep slopes, areas where the surface soil is loam, and small very stony areas and ponds. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Newood soil, slow in the lower part of the subsoil, and very slow in the substratum. Runoff is slow. The available water capacity is moderate. The content of organic matter in the surface layer is moderately low or moderate. The potential for frost action is moderate. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet. The rooting depth of some plants is limited by the firm substratum.

Most areas are used as woodland. The mature timber stands are mostly red maple, sugar maple, eastern hemlock, paper birch, and northern red oak, but white ash, aspen, yellow birch, and eastern hophornbeam are in most stands. The ground flora includes beaked hazelnut, wild sarsaparilla, rosy twistedstalk, Canada mayflower, bigleaf aster, partridgeberry, yellow beadlily, and mapleleaf viburnum. American starflower, bigleaf aster, brackenfern, wintergreen, and blueberry are in the ground flora in formerly burned areas.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen.

After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas.

If cultivated, this soil is subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve moisture. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing and water erosion, improve fertility, and conserve the water available for plant growth.

This soil is suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, and pasture renovation help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and the very slow permeability in the substratum. These limitations can be overcome by constructing a mound of suitable filtering material.

This soil is suited to dwellings without basements. It is only moderately suited to dwellings with basements because of the seasonal high water table, but basements can be constructed above the level of wetness.

Because of the risk of frost damage, this soil is only moderately suited to local roads. Frost action can be controlled by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3D. The habitat type commonly is ATM.

NpC—Newood-Pence sandy loams, 6 to 15 percent slopes. These rolling, moderately well drained and well drained soils are on outwash-veneered moraines. They are on swells, hills, and ridges and on the sides of valleys. Areas are elongated or irregularly shaped and commonly range from about 5 to 40 acres in size, but some are as large as 200 acres. The areas generally are about 55 to 65 percent Newood soil and 25 to 35 percent Pence soil. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

The Newood soil is moderately well drained. Typically, the surface layer is very dark gray sandy loam about 3 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The next layer is dark brown and brown sandy loam and brown and reddish brown gravelly loamy sand and gravelly sandy loam about 31 inches thick. The subsoil is reddish brown, mottled, firm gravelly sandy loam about 23 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled, firm gravelly sandy loam. In some areas the surface soil is very fine sandy loam or fine sandy loam. In a few areas the slope is less than 6 percent. In some places the subsoil is very cobbly or has a thin layer of sand and gravel. In other places the lower part of the soil is friable.

The Pence soil is well drained. Typically, the surface layer is black sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is about 22 inches thick. It is dark brown sandy loam and gravelly sandy loam in the upper part and strong brown gravelly sand in the lower part. The substratum to a depth of about 60 inches is brown sand. In some areas the surface soil is fine sandy loam or very fine sandy loam. In a few areas the slope is less than 6 percent. In places the substratum has thin layers of loamy deposits. In some places the soil is very cobbly.

Included with these soils in mapping are small areas of the moderately well drained Freeon and Sconsin soils and the somewhat poorly drained Magnor and Ossmer soils on the lower, less sloping parts of the landscape where the surface deposit is silty. Also included are small areas where the surface soil is loam, small ponds and wet spots in closed depressions, small areas where the slope is more than 15 percent, and small gravel pits and very stony areas. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Newood soil, slow in the lower part of the subsoil, and very slow in the substratum. It is moderately rapid in the upper part of the Pence soil and rapid or very rapid in the lower part. Runoff is medium on both soils. The available water capacity is moderate in the Newood soil and low in the Pence soil. The content of organic matter in the surface layer is moderate or moderately low in both soils. The potential for frost action is moderate in the Newood soil. The surface layer in both soils can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet in the Newood soil. The rooting depth of some plants is limited by the firm substratum in the Newood soil and, in places, by a substratum of sand and gravel in the Pence soil.

Most areas are used as woodland. The mature timber stands on the Newood soil are mostly red maple, sugar maple, and northern red oak, but paper birch, yellow birch, and eastern hophornbeam are in most stands. The ground flora includes beaked hazelnut, wild sarsaparilla, rosy twistedstalk, Canada mayflower, bigleaf aster, partridgeberry, yellow beadlily, mapleleaf viburnum, American starflower, spinulose woodfern, brackenfern, wintergreen, and blueberry. Eastern white pine is in the timber stands on the less productive Pence soil where mapleleaf viburnum is not in the ground flora.

These soils are suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted on the Newood soil in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping.

After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species in areas of the Newood soil. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

These soils are suited to corn and small grain and to grasses and legumes for hay and pasture. Crop yields are limited on the Pence soil because of the low available water content during dry periods. The soils are subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish. The substratum in the Pence soil is droughty and may be

difficult to vegetate if exposed during the construction of diversions or grassed waterways.

If cultivated, these soils are subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve moisture. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing and water erosion, improve fertility, and conserve the water available for plant growth.

These soils are suited to pasture, but the Pence soil is droughty during dry periods. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the Pence soil is dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, pasture renovation, and controlled grazing help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer when the soils are moist helps to maintain a productive stand of forage.

The Newood soil is poorly suited to septic tank absorption fields mainly because of the seasonal high water table and the very slow permeability in the substratum. Overcoming these limitations is difficult. A better site should be selected. The Pence soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity of the substratum may result in the pollution of ground water.

Because of the slope, the Newood soil is only moderately suited to dwellings without basements. It is moderately suited to dwellings with basements because of the seasonal high water table and the slope. It is moderately suited to local roads because of the slope and the risk of frost damage. The Pence soil is only moderately suited to dwellings and local roads because of the slope. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. In areas of the Newood soil, basements can be constructed above the level of wetness, but interceptor tile may be needed to carry off seepage from the higher adjacent slopes. The substratum of the Pence soil may cave in if it is excavated. It is droughty and is difficult to vegetate if it is exposed by land shaping. In areas of the Newood soil, the risk of frost damage on sites for local roads can be overcome by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts. The substratum of the Pence soil is a probable source of sand and gravel.

The land capability classification is IVe. Based on sugar maple productivity, the woodland ordination symbol is 3D for the Newood soil and 3A for the Pence soil. The habitat type commonly is ATM.

NwD—Newot gravelly sandy loam, 15 to 35 percent slopes. This hilly to very steep, well drained soil is on hills and ridges. Areas are elongated or irregularly shaped and range from about 5 to 200 acres in size.

Typically, the surface layer is black gravelly sandy loam about 2 inches thick. The subsurface layer is brown gravelly sandy loam about 3 inches thick. The next layer is dark brown, brown, and reddish brown gravelly sandy loam about 33 inches thick. The subsoil is reddish brown, firm gravelly sandy loam about 19 inches thick. The substratum to a depth of about 60 inches is reddish brown, firm gravelly sandy loam. In some areas the surface layer is very fine sandy loam or fine sandy loam. In a few areas the slope is more than 35 percent. In some places the lower part of the soil is friable, and in other places it has a thin layer of sand and gravel.

Included with this soil in mapping are small areas of the somewhat poorly drained Pesabic soils in swales and drainageways and the moderately well drained Newood soils on the less sloping parts of the landscape. Also included are small areas where the slope is less than 15 percent; areas where the surface soil is loam or silt loam; and small very stony areas, wet spots, and ponds. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Newot soil, slow in the lower part of the subsoil, and very slow in the substratum. Runoff is rapid. The available water capacity is moderate. The content of organic matter in the surface layer is moderately low or moderate. The potential for frost action is moderate. The rooting depth of some plants is limited by the firm substratum.

Most areas are used as woodland. The mature timber stands are mostly red maple, sugar maple, eastern hemlock, paper birch, and northern red oak, but white ash, aspen, yellow birch, and eastern hophornbeam are in most stands. The ground flora includes beaked hazelnut, wild sarsaparilla, rosy twistedstalk, Canada mayflower, grasses, partridgeberry, yellow beadlily, and mapleleaf viburnum. American starflower, bigleaf aster, brackenfern, wintergreen, and blueberry are in the ground flora in formerly burned areas.

This soil is suited to trees. The main concerns affecting woodland management are the erosion hazard, the equipment limitation, and seedling mortality. Erosion results from the concentration of runoff on

logging roads, skid trails, and landings. It can be minimized by logging, planting trees, and establishing roads and trails on the contour; yarding uphill by cable; and removing water by water bars, out-sloping road surfaces, and culverts. Drop structures may be needed to stabilize highly erodible areas. Seeding areas exposed by logging activities helps to establish a protective vegetative cover.

The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. The slope limits the selection of sites for logging roads and landings. Establishing the roads on the contour helps to maintain a low grade. Landings can be established on the included or adjacent soils that are nearly level or gently sloping. Yarding the logs by cable and planting trees by hand may be necessary in areas where the slope limits the use of equipment.

Seedling survival during dry periods can be improved on the droughty southern exposures by planting containerized seedlings or vigorous nursery stock when the soil is moist. After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is generally not suited to cultivated crops because of the slope and a severe hazard of erosion.

This soil is suited to pasture. It should be managed for bluegrass in areas where the slope prevents the use of machinery. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, and pasture renovation in areas where machinery can be used help to keep the pasture in good condition. In areas where machinery can be used, clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

Mainly because of the slope, this soil is generally unsuited to septic tank absorption fields and dwellings. Overcoming this limitation is difficult. A better site, such as a small included area of a better suited less sloping soil, should be selected.

This soil is poorly suited to local roads because of the slope. Land shaping is needed to reduce the slope, or the roads can be built on the contour.

The land capability classification is VIe. Based on sugar maple productivity, the woodland ordination symbol is 3R. The habitat type commonly is ATM.

OsA—Ossmer silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on low flats, on the lower parts of glacial lake basins, and in swales and drainageways in the uplands. The landscape is pitted in places. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are elongated or irregularly shaped and range from about 10 to 500 acres in size.

Typically, the surface layer is very dark gray silt loam about 4 inches thick. The subsurface layer is grayish brown, mottled silt loam about 2 inches thick. The next layer is brown and yellowish brown, mottled silt loam about 20 inches thick. The subsoil is dark brown, mottled loam and sandy loam about 12 inches thick. The substratum to a depth of about 60 inches is brown, mottled, stratified sand and gravelly sand. In some areas the upper layers are loam. In a few areas the upper silty deposits are more than 30 inches thick. In some places the substratum has thin layers of loamy deposits, and in other places it is at a depth of more than 45 inches. In some areas the substratum is cobbly.

Included with this soil in mapping are small areas of the very poorly drained Minocqua soils in depressions, the moderately well drained Sconsin soils on the higher parts of the landscape, and the somewhat poorly drained Worcester soils in areas where the surface deposit is sandy loam. Also included are small areas where loamy till or hard bedrock is within a depth of 60 inches; narrow areas that have steep slopes; areas where the substratum is within a depth of 20 inches; and small ponds, very stony areas, and sandy spots. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Ossmer soil and rapid or very rapid in the lower part. Runoff is slow. The available water capacity is moderate. The content of organic matter in the surface layer also is moderate. The potential for frost action is high. The surface layer can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after rainfall. A seasonal high water table is at a depth of 1 to 3 feet. The rooting depth of some plants is limited by the seasonal high water table and, in places, by the sand and gravel substratum.

Most areas are used as woodland. The timber stands are mostly red maple, balsam fir, and quaking aspen, but sugar maple, white ash, yellow birch, paper birch, and American hornbeam are in most stands. The ground flora includes Virginia waterleaf, ladyfern, rosy

twistedstalk, beaked hazelnut, wild sarsaparilla, Canada mayflower, yellow beadlily, American starflower, bunchberry dogwood, sensitive fern, trout lily, dewberry, and cinnamon fern. Horsetail, blueberry, or goldthread are in areas where the seasonal high water table persists for longer periods.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation and the windthrow hazard. The use of equipment is restricted in the spring, late in fall, and during other excessively wet periods because of the seasonal high water table and low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Also, culverts are needed to maintain the natural drainage system. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited.

A shallow rooting depth, which is caused by the high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. The wetness in undrained areas limits yields and the kinds of crops that can be grown. Some undrained areas formerly used as cropland are now idle or have been planted to pine, fir, or spruce. Field ditches, land smoothing, land grading, or a combination of these can remove excess surface water that accumulates during spring runoff and after heavy rains. Diversions on adjoining uplands or field ditches at the base of the adjoining uplands help to intercept and control runoff on this soil. Field ditches and tile drains can lower the water table. Because the substratum is unstable and may cave, the sides of the ditches should be flattened and continuous tubing should be used when tile drains are installed. Filters are needed to keep the fine particles of sand in the substratum from clogging the drains. Drainage tile may be displaced by frost action. This displacement can be prevented by using continuous tubing or by installing the tile drains below the depth of freezing. The field ditches can be used as outlets for tile drains in areas where a suitable drainage outlet is not available. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching improve fertility, increase the infiltration rate and the movement of air and water through the soil, and help to prevent crusting and puddling of the surface layer.

This soil is suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain unless the soil is drained. Excess water during wet periods may damage the forage. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the risk of frost damage. This limitation can be overcome by covering the soil with a coarse base material. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is 3W. The primary habitat type commonly is AViO or TMC. The secondary habitat type commonly is ATM or AH.

PaB—Padwet sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping or undulating, moderately well drained soil is on knolls and low flats and in swales and drainageways in the uplands. The landscape is pitted in places. Areas are elongated or irregularly shaped and range from about 10 to 200 acres in size.

Typically, the surface layer is black sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 3 inches thick. The next layer is brown and dark brown sandy loam about 29 inches thick. It is mottled in the lower part. The subsoil is dark brown, mottled sandy loam about 5 inches thick. The substratum to a depth of about 60 inches is yellowish brown, stratified sand and gravelly sand. In some areas the surface layer is fine sandy loam. In a few areas the

slope is 6 to 15 percent. In some places the substratum has thin layers of loamy deposits, and in other places it is loamy sand or gravelly loamy sand. In some areas the substratum is at a depth of more than 45 inches.

Included with this soil in mapping are small areas of the well drained Padus soils on the higher parts of the landscape, the moderately well drained Padwood soils in areas where stratified lacustrine deposits are at a depth of 40 to 60 inches, the moderately well drained Sconsin soils in areas where the surface deposit is silty, and the somewhat poorly drained Worcester soils in swales and drainageways. Also included are small areas where the substratum is within a depth of 24 inches; areas where the surface soil is loam or loamy sand; narrow areas that have steep slopes; areas where loamy till is within a depth of 60 inches; areas where a seasonal zone of near saturation is not present in the subsoil; and small ponds, wet spots, very stony areas, depressions, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Padwet soil and rapid or very rapid in the lower part. Runoff is slow. The available water capacity is moderate. The content of organic matter in the surface layer and the potential for frost action also are moderate. The surface layer can be easily tilled throughout a wide range in moisture content. A mottled, seasonal zone of near saturation is at a depth of 2.5 to 3.5 feet. The rooting depth of some plants is limited by the sand and gravel substratum.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, but red maple, northern red oak, American basswood, eastern hemlock, and white ash are in most stands. The ground flora includes wild sarsaparilla, Canada mayflower, beaked hazelnut, rosy twistedstalk, sweet cicely, smooth yellow violet, and ladyfern.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen.

After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. The substratum is droughty and may be difficult to vegetate if exposed during the construction of diversions, grassed waterways, or terraces.

If cultivated, this soil is subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve moisture. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing, improve fertility, and conserve the water available for plant growth. These measures also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

This soil is suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, and pasture renovation help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields because of the rapid or very rapid permeability in the substratum and the seasonal zone of near saturation. These limitations can be overcome by constructing a mound of suitable filtering material. In some areas the effluent can be pumped to an absorption field established on higher, better suited soils.

This soil is suited to dwellings, but the substratum may cave in if it is excavated. Because of the risk of frost damage, the soil is only moderately suited to local roads. Frost action can be controlled by replacing the upper part of the soil with coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is ATM. The secondary habitat type commonly is AViO.

PbB—Padwood sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping, moderately well

drained soil is on low terraces within or bordering the lower depressional areas and on the higher parts of glacial lake basins. Areas are elongated or irregularly shaped. They generally range from about 5 to 40 acres in size, but some are as large as 300 acres.

Typically, the surface layer is very dark gray sandy loam about 4 inches thick. The subsurface layer is brown sandy loam about 1 inch thick. The upper part of the subsoil is dark reddish brown and dark brown sandy loam about 10 inches thick. The next layer is brown and dark brown gravelly sandy loam about 12 inches thick. The lower part of the subsoil is strong brown gravelly loamy sand about 9 inches thick. The upper part of the substratum is light yellowish brown, mottled sand about 14 inches thick. The lower part to a depth of about 70 inches is strata of yellowish brown very fine sand, brown very fine sandy loam and silt loam, and strong brown fine sand. It is mottled. In some areas the surface layer is fine sandy loam or very fine sandy loam. In a few areas the slope is 6 to 15 percent. In places the lower part of the substratum is mostly stratified fine sand and loamy fine sand. In some places the lower part of the substratum is within a depth of 40 inches, and in other places it is loamy glacial till or contains strata of gravelly or very gravelly sand.

Included with this soil in mapping are small areas of the well drained Padus and moderately well drained Padwet soils in areas where the underlying deposit is sand and gravel to a depth of at least 60 inches and the somewhat poorly drained Worwood soils in swales. Padus soils are on the higher parts of the landscape. Also included are areas where the substratum is within a depth of 24 inches, areas where the surface soil is loam or loamy sand, narrow areas that have steep slopes, and small ponds and wet spots. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Padwood soil, rapid or very rapid in the upper part of the substratum, and moderately slow in the lower part of the substratum. Runoff is slow. The available water capacity is moderate. The content of organic matter in the surface layer and the potential for frost action also are moderate. The surface layer can be easily tilled throughout a wide range in moisture content. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet. The rooting depth of some plants is limited by the sand and gravel in the upper part of the substratum.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, but red maple, northern red oak, American basswood, eastern hemlock, and white ash are in most stands. The ground flora includes wild sarsaparilla, Canada mayflower, beaked hazelnut, rosy twistedstalk, sweet cicely, ladyfern, and smooth yellow violet.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen.

After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. The upper part of the substratum is droughty and may be difficult to vegetate if exposed during the construction of diversions, grassed waterways, or terraces.

If cultivated, this soil is subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve available water. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing, improve fertility, and conserve the water available for plant growth. These measures also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

This soil is suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, and pasture renovation help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields because of the moderately slow permeability in the lower part of the substratum, the rapid or very rapid permeability in the upper part of the substratum, and

the seasonal high water table. These limitations can be overcome by constructing a mound of suitable filtering material. In some areas the effluent can be pumped to an absorption field established on higher, better suited soils.

This soil is suited to dwellings without basements. It is only moderately suited to dwellings with basements because of the seasonal high water table, but basements can be constructed above the level of wetness.

Because of the risk of frost damage, this soil is only moderately suited to local roads. Frost action can be controlled by replacing the upper part of the soil with coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is ATM. The secondary habitat type commonly is AViO.

PbC—Padwood sandy loam, 6 to 15 percent slopes. This sloping, moderately well drained soil is on side slopes of glacial lake basins. Areas are long and narrow and range from about 5 to 20 acres in size.

Typically, the surface layer is very dark gray sandy loam about 3 inches thick. The subsurface layer is brown sandy loam about 1 inch thick. The subsoil is dark brown sandy loam about 6 inches thick. The next layer is brown and dark brown sandy loam about 26 inches thick. The upper part of the substratum is yellowish brown sand about 7 inches thick. The lower part to a depth of about 60 inches is strata of dark yellowish brown silt loam and brown very fine sand, loamy very fine sand, and fine sand. It is mottled. In some areas the surface layer is fine sandy loam or very fine sandy loam. In a few areas the slope is less than 6 percent. In places the lower part of the substratum is mostly stratified fine sand and loamy fine sand. In some areas the lower part of the substratum is within a depth of 40 inches, and in a few places it is loamy glacial till or contains strata of gravelly or very gravelly sand.

Included with this soil in mapping are small areas of the well drained Padus soils in positions on the landscape similar to those of the Padwood soil. Padus soils have a substratum of sand and gravel to a depth of about 60 inches. Also included are areas where the substratum is within a depth of 24 inches, areas where the surface soil is loam or loamy sand, small areas where the slope is more than 15 percent, and small ponds and wet spots. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Padwood soil, rapid or very rapid in the upper part of the substratum, and moderately slow in the lower part of the substratum. Runoff is medium. The available water capacity is moderate. The content of organic matter in the surface layer and the potential for frost action also are moderate. The surface layer can be easily tilled throughout a wide range in moisture content. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet. The rooting depth of some plants is limited by the sand and gravel in the upper part of the substratum.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, but red maple, northern red oak, American basswood, eastern hemlock, and white ash are in most stands. The ground flora includes wild sarsaparilla, Canada mayflower, beaked hazelnut, rosy twistedstalk, sweet cicely, ladyfern, and smooth yellow violet.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping.

After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish. The upper part of the substratum is droughty and may be difficult to vegetate if exposed during the construction of diversions or grassed waterways.

If cultivated, this soil is subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve available water. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing and

water erosion, improve fertility, and conserve the water available for plant growth.

This soil is suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, and pasture renovation help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields mainly because of the seasonal high water table, the moderately slow permeability in the lower part of the substratum, and the rapid or very rapid permeability in the upper part of the substratum. Overcoming these limitations is difficult. A better site should be selected. In some areas the effluent can be pumped to an absorption field established on a better suited soil.

Because of the slope, this soil is only moderately suited to dwellings without basements. Because of the seasonal high water table and the slope, it is moderately suited to dwellings with basements. The soil is only moderately suited to local roads because of the risk of frost damage and the slope. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. Basements can be constructed above the level of wetness. Interceptor tile may be needed to carry off the seepage from the higher adjacent slopes. On sites for local roads, frost action can be controlled by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is ATM. The secondary habitat type commonly is AViO.

PcC—Pence-Antigo complex, 6 to 15 percent slopes. These sloping or rolling, well drained soils are on swells, hills, and ridges and on the sides of valleys, kettles, and basins. Areas are long and narrow or irregularly shaped and range from about 5 to 60 acres in size. They are about 65 to 75 percent Pence soil and 15 to 25 percent Antigo soil. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Pence soil has a surface layer of very dark gray loam about 3 inches thick. The subsurface layer is brown loam about 2 inches thick. The subsoil is dark brown loam, gravelly sandy loam, and very gravelly loamy sand about 17 inches thick. The substratum to a depth of about 60 inches is brown, stratified gravelly sand and very gravelly sand. In some areas the surface layer is silt loam or gravelly loam. In a few areas the slope is less than 6 percent. In places the substratum has thin layers of loamy deposits, and in a few areas the soil is very cobbly.

Typically, the Antigo soil has a surface layer of very dark gray silt loam about 3 inches thick. The subsurface layer is brown silt loam about 1 inch thick. The next layer is dark brown, brown, and dark yellowish brown silt loam and loam about 21 inches thick. The subsoil is dark brown gravelly sandy loam and gravelly loamy sand about 9 inches thick. The substratum to a depth of about 60 inches is brown, stratified very gravelly sand and gravelly sand. In some areas the upper layers are loam. In a few areas the slope is less than 6 percent. In places the substratum is at a depth of more than 40 inches, and in a few areas it has thin layers of loamy deposits. In some areas the substratum is very cobbly.

Included with these soils in mapping are small areas of the somewhat poorly drained Ossmer and moderately well drained Sconsin soils in swales and drainageways. Also included are small areas where loamy till is within a depth of 60 inches; areas where the surface soil is very fine sandy loam to sandy loam; small areas where the slope is more than 15 percent; and small ponds, wet spots, very stony areas, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the Pence soil and moderate in the upper part of the Antigo soil. It is rapid or very rapid in the lower part of both soils. Runoff is medium on both soils. The available water capacity is low in the Pence soil and moderate in the Antigo soil. The content of organic matter in the surface layer is moderate or moderately low. The potential for frost action is high in the Antigo soil. The surface layer of both soils can be easily tilled throughout a wide range in moisture content. The surface layer of the Antigo soil tends to crust or puddle after rainfall. In places the rooting depth of some plants is limited by the sand and gravel substratum in both soils.

Most areas are used as woodland. The mature timber stands on the droughty Pence soil are mostly sugar maple, paper birch, and red maple, but northern red oak and eastern white pine are in most stands. The ground flora includes grasses, wild sarsaparilla, beaked hazelnut, Canada mayflower, bigleaf aster, yellow beadlily, and brackenfern. Sugar maple, American basswood, and white ash are the dominant species on the Antigo soil where blue cohosh, sweet cicely, four-lined honeysuckle, smooth yellow violet, ladyfern, Virginia waterleaf, largeflowered bellwort, snow trillium, and bloodroot are in the ground flora. Black cherry and

yellow birch also are in the timber stands on the Antigo soil.

These soils are suited to trees. The main concern affecting woodland management is the equipment limitation in areas of the Antigo soil. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species in areas of the Antigo soil. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

These soils are suited to corn and small grain and to grasses and legumes for hay and pasture. Crop yields are limited on the Pence soil because of the low available water content during dry periods. The soils are subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish. The substratum in both soils is droughty and may be difficult to vegetate if exposed during construction of diversions or grassed waterways. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the Antigo soil, improve fertility, help to prevent crusting and puddling of the surface layer in the Antigo soil, conserve moisture, and help to prevent excessive water erosion.

These soils are suited to pasture, but the Pence soil is droughty during dry periods. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the Antigo soil is too wet or when the Pence soil is too dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, pasture renovation, and controlled grazing help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer when the soils are moist helps to maintain a productive stand of forage.

These soils readily absorb but do not adequately filter the effluent from septic tanks. The poor filtering capacity of the substratum may result in the pollution of ground water. The soils are only moderately suited to dwellings because of the slope. The Pence soil is only moderately suited to local roads because of the slope. The Antigo soil is poorly suited to local roads because of the risk of frost damage. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. The substratum may cave in if it is excavated. It is droughty and is difficult to vegetate if it is exposed by land shaping. On the Antigo soil, frost damage to local roads can be controlled by replacing the upper part of the soil with coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts. The substratum is a probable source of sand and gravel.

The land capability classification is IVe. Based on sugar maple productivity, the woodland ordination symbol is 3A for the Pence soil and 3L for the Antigo soil. The primary habitat type commonly is ATM. The secondary habitat type commonly is AViO.

PeB—Pence-Padus sandy loams, 1 to 6 percent slopes. These nearly level and gently sloping or undulating, well drained soils are on knolls and upland flats and on the sides of drainageways, kettles, and basins. The landscape is pitted in places. Areas are elongated or irregularly shaped and range from about 10 to 500 acres in size. They are about 55 to 65 percent Pence soil and 25 to 35 percent Padus soil. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Pence soil has a surface layer of very dark gray sandy loam about 3 inches thick. The subsurface layer is brown sandy loam about 1 inch thick. The subsoil is about 30 inches thick. It is dark brown sandy loam in the upper part and strong brown gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown, stratified gravelly sand and sand. In some areas the surface layer is fine sandy loam. In a few areas the slope is 6 to 15 percent. In places the substratum has thin layers of loamy deposits, and in a few areas it is loamy sand or gravelly loamy sand.

Typically, the Padus soil has a surface layer of very dark gray sandy loam about 3 inches thick. The subsurface layer is brown sandy loam about 1 inch

thick. The next layer is dark brown and brown sandy loam about 25 inches thick. The subsoil is strong brown very gravelly loamy sand about 9 inches thick. The substratum to a depth of about 60 inches is brown very gravelly sand. In some areas the surface layer is fine sandy loam. In a few areas the slope is 6 to 15 percent. In places the substratum has thin layers of loamy deposits, and in a few areas it is loamy sand or gravelly loamy sand. In some areas the substratum is at a depth of more than 45 inches.

Included with these soils in mapping are small areas of the well drained Antigo soils in areas where the surface deposit is silty and the moderately well drained Padwet and somewhat poorly drained Worcester soils in swales and drainageways. Also included are small areas where the surface soil is loam or loamy sand; areas where loamy till is within a depth of 60 inches; narrow areas that have steep slopes; and small ponds, wet spots, very stony areas, gravel pits, and depressions. Included areas make up less than 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the Pence soil and moderate in the upper part of the Padus soil. It is rapid or very rapid in the lower part of both soils. Runoff is slow on both soils. The available water capacity is low in the Pence soil and moderate in the Padus soil. The content of organic matter in the surface layer is moderate or moderately low in both soils. The potential for frost action is moderate in the Padus soil. The surface layer of both soils can be easily tilled throughout a wide range in moisture content. In places the rooting depth of some plants is limited by the sand and gravel substratum in both soils.

Most areas are used as woodland. The mature timber stands on the Pence soil are mostly sugar maple, paper birch, and red maple. The ground flora includes grasses, Canada mayflower, brackenfern, beaked hazelnut, yellow beadlily, wild sarsaparilla, and bigleaf aster. Sugar maple is the dominant species on the more productive Padus soil where sweet cicely, smooth yellow violet, and ladyfern are in the ground flora. American basswood, northern red oak, white ash, and eastern hemlock are in most stands. Eastern white pine also is in timber stands on the Pence soil (fig. 17).

These soils are suited to trees. The main concern affecting woodland management is the equipment limitation in areas of the Padus soil. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen.

After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species in areas of the Padus soil. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

These soils are suited to corn and small grain and to grasses and legumes for hay and pasture. Crop yields are limited on the Pence soil because of the low available water content during dry periods. The soils are subject to water erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. The substratum in both soils is droughty and may be difficult to vegetate if exposed during the construction of diversions, grassed waterways, or terraces.

If cultivated, these soils are subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve moisture. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing, improve fertility, and conserve the water available for plant growth. They also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

These soils are suited to pasture, but the Pence soil is droughty during dry periods. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the Pence soil is dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, pasture renovation, and controlled grazing help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer when the soils are moist helps to maintain a productive stand of forage.

These soils readily absorb but do not adequately filter the effluent from septic tanks. The poor filtering capacity of the substratum may result in the pollution of ground water. The soils are suited to dwellings, but the substratum may cave in if it is excavated. The Pence soil is suited to local roads. The Padus soil is only moderately suited because of the risk of frost damage. Frost action can be controlled by replacing the upper part of the soil with a coarse base material and by

Figure 17.—Eastern white pine in an area of Pence-Padus sandy loams, 1 to 6 percent slopes. The pine grows in the droughty areas of the Pence soil, where sugar maple is less competitive.

installing a good subsurface drainage system of adequate side ditches and culverts. The substratum is a probable source of sand and gravel.

The land capability classification is IIIe. Based on sugar maple productivity, the woodland ordination symbol is 3A for the Pence soil and 3L for the Padus

soil. The primary habitat type commonly is ATM. The secondary habitat type commonly is AViO.

PeC—Pence-Padus sandy loams, 6 to 15 percent slopes. These sloping or rolling, well drained soils are on swells, hills, and ridges and on the sides of valleys, kettles, and basins. Areas are long and narrow or irregularly shaped and range from about 5 to 500 acres in size. They are about 60 to 70 percent Pence soil and 20 to 30 percent Padus soil. The two soils commonly occur as areas so intricately intermingled or so small that mapping them separately was not practical.

Typically, the Pence soil has a surface layer of very dark gray sandy loam about 3 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is about 22 inches thick. It is dark brown sandy loam in the upper part and strong brown very gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown, stratified gravelly sand and very gravelly sand. In some areas the surface layer is fine sandy loam. In a few areas the slope is less than 6 percent. In places the substratum has thin layers of loamy deposits, and in a few areas it is loamy sand or gravelly loamy sand.

Typically, the Padus soil has a surface layer of very dark gray sandy loam about 4 inches thick. The subsurface layer is brown sandy loam about 6 inches thick. The next layer is dark reddish brown, brown, and dark brown sandy loam about 13 inches thick. The subsoil is about 16 inches thick. It is dark brown sandy loam in the upper part and dark brown very gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is brown, stratified gravelly sand and sand. In some areas the surface layer is fine sandy loam. In a few areas the slope is less than 6 percent. In places the substratum has thin layers of loamy deposits, and in a few areas it is loamy sand or gravelly loamy sand. In some areas the substratum is at a depth of more than 45 inches.

Included with these soils in mapping are small areas of the well drained Antigo soils in areas where the surface deposit is silty, the moderately well drained Padwet soils, the excessively drained Sayner soils, and the somewhat poorly drained Worcester soils. Worcester and Padwet soils are in swales and drainageways. Sayner soils are in positions on the landscape similar to those of the Pence and Padus soils. They have sandy upper layers. Also included are small areas where the surface soil is loam; areas where loamy till is within a depth of 60 inches; small areas where the slope is more than 15 percent; and small ponds, wet spots, very stony areas, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the Pence soil and moderate in the upper part of the Padus soil. It is rapid or very rapid in the lower part of both soils. Runoff is medium on both soils. The available water capacity is low in the Pence soil and moderate in the Padus soil. The content of organic matter in the surface layer is moderate or moderately low in both soils. The potential for frost action is moderate in the Padus soil. The surface layer of both soils can be easily tilled throughout a wide range in moisture content. In places the rooting depth of some plants is limited by the sand and gravel substratum in both soils.

Most areas are used as woodland. The mature timber stands on the Pence soil are mostly sugar maple, paper birch, and red maple. The ground flora includes grasses, Canada mayflower, brackenfern, beaked hazelnut, yellow beadlily, wild sarsaparilla, and bigleaf aster. Sugar maple is the dominant species on the more productive Padus soil where sweet cicely, smooth yellow violet, and ladyfern are in the ground flora. American basswood, northern red oak, white ash, and eastern hemlock are in most stands. Eastern white pine also is in timber stands on the Pence soil.

These soils are suited to trees. The main concern affecting woodland management is the equipment limitation in areas of the Padus soil. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping.

After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species in areas of the Padus soil. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

These soils are suited to corn and small grain and to grasses and legumes for hay and pasture. Crop yields are limited on the Pence soil because of the low available water content during dry periods. The soils are subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish. The

substratum in both soils is droughty and may be difficult to vegetate if exposed during the construction of diversions or grassed waterways.

If cultivated, these soils are subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve moisture. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing and water erosion, improve fertility, and conserve the water available for plant growth.

These soils are suited to pasture, but the Pence soil is droughty during dry periods. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the Pence soil is dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, pasture renovation, and controlled grazing help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer when the soils are moist helps to maintain a productive stand of forage.

These soils readily absorb but do not adequately filter the effluent from septic tanks. The poor filtering capacity of the substratum may result in the pollution of ground water. The soils are only moderately suited to dwellings because of the slope. They are only moderately suited to local roads because of the slope. The risk of frost damage is an additional problem affecting local roads in areas of the Padus soil. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. The substratum may cave in if it is excavated. It is droughty and is difficult to vegetate if it is exposed by land shaping. On the Padus soil, frost damage to local roads can be controlled by replacing the upper part of the soil with coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts. The substratum is a probable source of sand and gravel.

The land capability classification is IVe. Based on sugar maple productivity, the woodland ordination symbol is 3A for the Pence soil and 3L for the Padus soil. The primary habitat type commonly is ATM. The secondary habitat type commonly is AViO.

PeD—Pence-Padus sandy loams, 15 to 35 percent slopes. These moderately steep or hilly to very steep, well drained soils are on hills and ridges and on the sides of valleys, kettles, and basins. Areas are long and narrow or irregularly shaped and range from about 5 to 800 acres in size. They are about 65 to 75 percent Pence soil and 15 to 25 percent Padus soil. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Pence soil has a surface layer of very dark gray sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 1 inch thick. The subsoil is about 22 inches thick. It is dark reddish brown sandy loam in the upper part, reddish brown loamy sand in the next part, and dark brown sand in the lower part. The substratum to a depth of about 60 inches is brown very gravelly sand. In some areas the surface layer is fine sandy loam. In a few areas the slope is more than 35 percent. In places the substratum has thin layers of loamy deposits, and in a few areas it is loamy sand or gravelly loamy sand.

Typically, the Padus soil has a surface layer of black sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 1 inch thick. The next layer is dark reddish brown, dark brown, brown, and reddish brown sandy loam about 24 inches thick. The subsoil is reddish brown sandy loam about 6 inches thick. The substratum to a depth of about 60 inches is brown gravelly sand. In some areas the surface layer is fine sandy loam. In a few areas the slope is more than 35 percent. In places the substratum has thin layers of loamy deposits, and in a few areas it is loamy sand or gravelly loamy sand. In some areas the substratum is at a depth of more than 45 inches.

Included with these soils in mapping are small areas of the moderately well drained Padwet, excessively drained Sayner, and somewhat poorly drained Worcester soils. Worcester and Padwet soils are in swales and drainageways. Sayner soils are in positions on the landscape similar to those of the Pence and Padus soils. They have sandy upper layers. Also included are small areas where the surface soil is loam or silt loam; areas where loamy till is within a depth of 60 inches; small areas where the slope is less than 15 percent; and small ponds, wet spots, very stony areas, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the Pence soil and moderate in the upper part of the Padus soil. It is rapid or very rapid in the lower part of both soils. Runoff is rapid on both soils. The available water capacity is low in the Pence soil and moderate in the Padus soil. The content of organic matter in the surface layer is moderate or moderately low in both soils. The potential for frost action is moderate in the Padus soil. In places the rooting depth of some plants is limited by a sand and gravel substratum in both soils.

Most areas are used as woodland. The mature timber stands on the Pence soil are mostly sugar

maple, paper birch, and red maple. The ground flora includes grasses, Canada mayflower, brackenfern, beaked hazelnut, yellow beadlily, wild sarsaparilla, and bigleaf aster. Sugar maple is the dominant species on the more productive Padus soil where sweet cicely, smooth yellow violet, and ladyfern are in the ground flora. American basswood, northern red oak, white ash, and eastern hemlock are in most stands. Eastern white pine also is in timber stands on the Pence soil.

These soils are suited to trees. The main concerns affecting woodland management are the erosion hazard, the equipment limitation, and seedling mortality. Erosion results from the concentration of runoff on logging roads, skid trails, and landings. It can be minimized by logging, planting trees, and establishing roads and trails on the contour; yarding uphill by cable; and removing water by water bars, out-sloping road surfaces, and culverts. Drop structures may be needed to stabilize highly erodible areas. Seeding areas exposed by logging activities helps to establish a protective vegetative cover.

On the Padus soil, the use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. The slope limits the selection of sites for logging roads and landings. Establishing the roads on the contour helps to maintain a low grade. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping. Yarding the logs by cable and planting trees by hand may be necessary in areas where the slope limits the use of equipment.

Seedling survival during dry periods can be improved on the droughty southern exposures by planting containerized seedlings or vigorous nursery stock when the soils are moist. After trees are cut, plant competition can be expected to delay the natural regeneration of desirable tree species in areas of the Padus soil. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

These soils are generally not suited to cultivated crops because of the slope, the low available water capacity of the Pence soil, and a severe hazard of erosion.

These soils are suited to pasture. Forage yields are limited on the Pence soil because of the low available water content during dry periods. The soils should be managed for bluegrass in areas where the slope prevents the use of machinery. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the Pence soil is dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation in areas where machinery can be used, and restricted use of the Pence soil during dry periods help to keep the pasture in good condition. In areas where machinery can be used, clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer when the soils are moist helps to maintain a productive stand of forage.

These soils are generally unsuited to septic tank absorption fields and dwellings mainly because of the slope. Overcoming this limitation is difficult. A better site, such as a small included area of a better suited less sloping soil, should be selected.

These soils are poorly suited to local roads because of the slope. Land shaping is needed to reduce the slope, or the roads can be built on the contour. The substratum may cave in if it is excavated. It is droughty and is difficult to vegetate if exposed by land shaping. It also is a probable source of sand and gravel.

The land capability classification is VIIe. Based on sugar maple productivity, the woodland ordination symbol is 3R. The primary habitat type commonly is ATM. The secondary habitat type commonly is AViO.

PsB—Pesabic fine sandy loam, 0 to 4 percent slopes. This nearly level and gently sloping or undulating, somewhat poorly drained soil is on low swells and knolls in low areas, on the broad crests and foot slopes of drumlins, and in upland swales and drainageways. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are elongated or irregularly shaped and range from about 10 to 200 acres in size.

Typically, the surface layer is black fine sandy loam about 4 inches thick. The subsurface layer is brown fine sandy loam about 1 inch thick. The upper part of the subsoil is dark brown, mottled fine sandy loam about 8 inches thick. The next layer is brown, dark brown, and reddish brown sandy loam and gravelly sandy loam about 20 inches thick. It is mottled. The lower part of the subsoil is reddish brown, mottled, firm sandy loam about 20 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled, firm fine sandy loam. In some areas the surface layer is sandy loam or very fine sandy loam. In a few areas the slope is 5 or 6 percent. In places the subsoil has thin layers of silty deposits. In some areas the lower part of the soil is

friable, and in a few areas it has a thin layer of sand and gravel.

Included with this soil in mapping are small areas of the somewhat poorly drained Magnor soils in areas where the surface deposit is silty, the moderately well drained Newood soils on the higher parts of the landscape, and the very poorly drained Capitola soils in drainageways. Also included are many small areas of very poorly drained organic soils in depressions, areas where the surface layer is loam, narrow areas that have steep slopes, small very stony areas, and ponds. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Pesabic soil, slow in the lower part of the subsoil, and very slow in the substratum. Runoff is slow. The available water capacity is moderate. The content of organic matter in the surface layer also is moderate. The potential for frost action is high. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. A perched seasonal high water table is at a depth of 0.5 foot to 2.0 feet. The rooting depth of some plants is limited by the perched seasonal high water table and the firm substratum.

Most areas are used as woodland. The timber stands are mostly red maple and sugar maple, but northern red oak, yellow birch, paper birch, and eastern hemlock are in most stands. The ground flora includes beaked hazelnut, bunchberry dogwood, goldthread, Canada mayflower, American starflower, wild sarsaparilla, yellow beadlily, rosy twistedstalk, partridgeberry, and mapleleaf viburnum. Red maple, balsam fir, and quaking aspen are the dominant species on foot slopes where the perched seasonal high water table persists for longer periods (fig. 18). These wetter areas have sensitive fern, wood sorrel, horsetail, or cinnamon fern in the ground flora.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation, seedling mortality, and the windthrow hazard. The use of equipment is restricted in the spring and in other excessively wet periods because of the perched seasonal high water table and low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. Logging roads and landings that have a gravel base can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited. Adequate culverts are needed on graveled roads to maintain the natural drainage system.

The seedling mortality resulting from soil wetness can be reduced by planting vigorous nursery stock on the crest of cradle-knolls or on prepared ridges. A shallow rooting depth, which is caused by the perched high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. The wetness in undrained areas limits yields and the kinds of crops that can be grown. Field ditches and tile drains can be used in the nearly level areas to help remove the perched water table. The field ditches can be used as outlets for tile drains in areas where a suitable drainage outlet is not available. Drainage tile may be displaced by frost action. This displacement can be prevented by using continuous tubing or by installing the tile drains below the depth of freezing.

This soil is subject to water erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas.

If drained and cultivated, this soil is subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure improve fertility and help to control soil blowing. These measures also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

This soil is suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain unless the soil is drained. Excess water during wet periods may damage the forage. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, and pasture renovation help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth

Figure 18.—Balsam fir in an area of Pesabic fine sandy loam, 0 to 4 percent slopes.

and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the seasonal high water table and the risk of frost damage. These limitations can be overcome by adding a coarse base material to raise the roadbed above the level of wetness. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is

3W. The primary habitat type commonly is TMC. The secondary habitat type commonly is ATM.

Pt—Pits, gravel. This map unit is in areas where sand and gravel have been removed. It is mostly on moraines, outwash plains, eskers, or kames. The floors of the pits commonly are nearly level or gently sloping. The sidewalls range from moderately steep to nearly vertical. Areas have linear borders or are irregular in shape and range from about 5 to 50 acres in size.

Typically, the floors and sides of the pits are sand and gravel in which the content of cobbles is as much as 15 percent. In places the floors and sides are loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam that contains stones.

Included in mapping are piles of soil material removed from the pit area prior to excavation and piles of material within the pits that were discarded because of excess fines or a lack of gravel. Also included are stones or boulders too large to be crushed.

Many pits are still in use. Some have been abandoned and are overgrown with brush and weeds. Some of the abandoned pits are used as sanitary landfills. Water is in a few pits.

The main management concern is reclamation of the pits after excavation. In most of the pits, land shaping and additions of suitable topsoil are needed before a plant cover can be established. Vegetation can be established if the piles of finer textured material that was pushed aside prior to excavation are spread over the coarse sand and gravel. The slope of the sidewalls can be reduced by cutting and filling.

Onsite investigation is needed to determine the suitability of this map unit for septic tank absorption fields, dwellings, and local roads.

This map unit is not assigned a land capability classification, a woodland ordination symbol, or a habitat type.

SaC—Sarona-Pence sandy loams, 6 to 15 percent slopes. These sloping or rolling, well drained soils are on swells, hills, and ridges and on the sides of drumlins. Areas are elongated or irregularly shaped and range from about 10 to several thousand acres in size. They generally are 55 to 65 percent Sarona soil and 25 to 35 percent Pence soil, but some areas are entirely Sarona soil. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Sarona soil has a surface layer of very dark gray sandy loam about 3 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is dark reddish brown, reddish brown, and dark brown sandy loam about 13 inches thick. Below this to a depth of about 60 inches is reddish brown and brown sandy loam and brown loamy sand. In some areas the surface layer is loam or fine sandy loam. In a few areas the slope is less than 6 percent. In places the lower part of the soil has a thin layer of sand and gravel.

Typically, the Pence soil has a surface layer of black sandy loam about 4 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is about 24 inches thick. It is dark reddish brown gravelly sandy loam in the upper part and dark reddish brown and dark brown very gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas the surface layer is loam, fine sandy loam, or gravelly sandy loam. In a few areas the slope is less than 6 percent. In places the substratum has thin layers of loamy deposits. In a few places the soil is very gravelly or very cobbly throughout.

Included with these soils in mapping are small areas of the well drained Goodman soils in areas where the surface deposit is silty, the somewhat poorly drained Moodig soils in swales and drainageways, and the moderately well drained Sarwet soils on the less sloping parts of the landscape. Also included are many small areas of very poorly drained organic soils in depressions; small areas where the slope is more than 15 percent; some areas where the surface soil is sandy and droughty; and small very stony areas, ponds, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Sarona soil and moderate or moderately rapid in the substratum. It is moderately rapid in the upper part of the Pence soil and rapid or very rapid in the lower part. Runoff is medium on both soils. The available water capacity is moderate in the Sarona soil and low in the Pence soil. The content of organic matter in the surface layer of both soils is moderate or moderately low. The potential for frost action is moderate in the Sarona soil. The surface layer of both soils can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. In places the rooting depth of some plants is limited by a sand and gravel substratum in the Pence soil.

Most areas are used as woodland. The mature timber stands on the more productive Sarona soil are mostly sugar maple. The ground flora includes wild sarsaparilla, Canada mayflower, rosy twistedstalk, mapleleaf viburnum, beaked hazelnut, sweet cicely, smooth yellow violet, and ladyfern. Sugar maple, red maple, and paper birch are the dominant species on the Pence soil where sweet cicely, smooth yellow violet, and ladyfern are not in the ground flora. Northern red

oak, American basswood, eastern hemlock, and white ash are in most stands. Eastern white pine also is in timber stands on the Pence soil.

These soils are suited to trees. The main concern affecting woodland management is the equipment limitation in areas of the Sarona soil. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. The slope limits the selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species in areas of the Sarona soil. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

These soils are suited to corn and small grain and to grasses and legumes for hay and pasture. Crop yields are limited on the Pence soil because of the low available water content during dry periods. The soils are subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Critical-area planting helps to stabilize highly erodible areas where vegetation is difficult to establish. The substratum in the Pence soil is droughty and may be difficult to vegetate if exposed during the construction of diversions or grassed waterways.

If cultivated, these soils are subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve moisture. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing and water erosion, improve fertility, and conserve the water available for plant growth.

These soils are suited to pasture, but the Pence soil is droughty during dry periods. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the Pence soil is dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, pasture renovation, and controlled grazing help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer when the soils are moist helps to maintain a productive stand of forage.

The Sarona soil is only moderately suited to septic tank absorption fields because of the slope. Lateral seepage and the surfacing of septic tank effluent in downslope areas can be controlled by installing a trench absorption system on the contour. The Pence soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity of the substratum may result in the pollution of ground water.

Because of the slope, these soils are only moderately suited to dwellings. They are only moderately suited to local roads because of the slope. The risk of frost damage is an additional problem affecting local roads in areas of the Sarona soil. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. The substratum of the Pence soil may cave in if it is excavated. It is droughty and is difficult to vegetate if it is exposed by land shaping. In areas of the Sarona soil, frost damage to local roads can be controlled by replacing the upper part of the soil with coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts. The substratum of the Pence soil is a probable source of sand and gravel.

The land capability classification is IVe. Based on sugar maple productivity, the woodland ordination symbol is 3L for the Sarona soil and 3A for the Pence soil. The primary habitat type commonly is ATM. The secondary habitat type commonly is AViO.

SaD—Sarona-Pence sandy loams, 15 to 35 percent slopes. These hilly to very steep, well drained soils are on hills and ridges. Areas are elongated or irregularly shaped. They generally range from about 5 to 500 acres in size, but many are less than 40 acres. The areas generally are 65 to 75 percent Sarona soil and 15 to 25 percent Pence soil, but some are entirely Sarona soil. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Sarona soil has a surface layer of very dark gray sandy loam about 1 inch thick. The subsurface layer is brown sandy loam about 1 inch thick. The subsoil is dark reddish brown and reddish brown sandy loam about 13 inches thick. Below this to a depth of about 60 inches is brown and reddish brown loamy sand and reddish brown sandy loam. In some areas the surface layer is loam or fine sandy loam. In a

few areas the slope is more than 35 percent. In places the lower part of the soil has a thin layer of sand and gravel.

Typically, the Pence soil has a surface layer of black sandy loam about 4 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is about 20 inches thick. It is dark reddish brown gravelly sandy loam in the upper part, reddish brown very gravelly loamy sand in the next part, and dark brown very gravelly sand in the lower part. The substratum to a depth of about 60 inches is brown gravelly sand. In some areas the surface layer is loam, fine sandy loam, or gravelly sandy loam. In a few areas the slope is more than 35 percent. In places the substratum has thin layers of loamy deposits. In a few places the soil is very gravelly or very cobbly throughout.

Included with these soils in mapping are small areas of the somewhat poorly drained Moodig soils in swales and drainageways and the moderately well drained Sarwet soils on the lower parts of the landscape. Also included are some areas where the surface soil is sandy and droughty; small areas where the surface soil is silt loam; small areas where the slope is less than 15 percent; and small very stony areas, ponds, wet spots, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Sarona soil and moderate or moderately rapid in the substratum. It is moderately rapid in the upper part of the Pence soil and rapid or very rapid in the lower part. Runoff is rapid on both soils. The available water capacity is moderate in the Sarona soil and low in the Pence soil. The content of organic matter in the surface layer of both soils is moderate or moderately low. The potential for frost action is moderate in the Sarona soil. In places the rooting depth of some plants is limited by a sand and gravel substratum in the Pence soil.

Most areas are used as woodland. The mature timber stands on the more productive Sarona soil are mostly sugar maple. The ground flora includes wild sarsaparilla, Canada mayflower, rosy twistedstalk, mapleleaf viburnum, beaked hazelnut, sweet cicely, smooth yellow violet, and ladyfern. Sugar maple, red maple, and paper birch are the dominant species on the Pence soil where sweet cicely, smooth yellow violet, and ladyfern are not in the ground flora. Northern red oak, American basswood, eastern hemlock, and white ash are in most stands. Eastern white pine also is in timber stands on the Pence soil.

These soils are suited to trees. The main concerns affecting woodland management are the erosion hazard, the equipment limitation, and seedling mortality. Erosion results from the concentration of runoff on logging roads, skid trails, and landings. It can be minimized by logging, planting trees, and establishing roads and trails on the contour; yarding uphill by cable; and removing water by water bars, out-sloping road surfaces, and culverts. Drop structures may be needed to stabilize highly erodible areas. Seeding areas exposed by logging activities helps to establish a protective vegetative cover.

On the Sarona soil, the use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. The slope limits the selection of sites for logging roads and landings. Establishing the roads on the contour helps to maintain a low grade. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping. Yarding the logs by cable and planting trees by hand may be necessary in areas where the slope limits the use of equipment.

Seedling survival during dry periods can be improved on the droughty southern exposures by planting containerized seedlings or vigorous nursery stock when the soils are moist. After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species in areas of the Sarona soil. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

These soils are generally not suited to cultivated crops because of the slope, the low available water capacity of the Pence soil, and a severe hazard of erosion.

These soils are suited to pasture. Forage yields are limited on the Pence soil because of the low available water content during dry periods. The soils should be managed for bluegrass in areas where the slope prevents the use of machinery. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the Pence soil is dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation in areas where machinery can be used, and restricted use of the Pence soil during dry periods help to keep the pasture in good condition. In areas where machinery can be used, clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of

regrowth and grazing. Topdressing with fertilizer when the soils are moist helps to maintain a productive stand of forage.

These soils are generally unsuited to septic tank absorption fields and dwellings mainly because of the slope. Overcoming this limitation is difficult. A better site, such as a small included area of a better suited less sloping soil, should be selected.

These soils are poorly suited to local roads because of the slope. Land shaping is needed to reduce the slope, or the roads can be built on the contour. The substratum of the Pence soil may cave in if it is excavated. It is droughty and is difficult to vegetate if exposed by land shaping. It also is a probable source of sand and gravel.

The land capability classification is VIIe. Based on sugar maple productivity, the woodland ordination symbol is 3R. The primary habitat type commonly is ATM. The secondary habitat type commonly is AViO.

SbB—Sarwet sandy loam, 2 to 6 percent slopes. This gently sloping or undulating, moderately well drained soil is on low swells or knolls and on the crests and sides of drumlins. Areas are elongated or irregularly shaped and range from about 5 to 100 acres in size.

Typically, the surface layer is very dark gray sandy loam about 5 inches thick. The subsurface layer is brown loamy sand about 1 inch thick. The upper part of the subsoil is dark brown sandy loam about 16 inches thick. The next layer is mostly pale brown and brown, mottled gravelly sandy loam about 49 inches thick. The lower part of the subsoil is brown, mottled gravelly sandy loam about 13 inches thick. The substratum to a depth of about 90 inches is brown very gravelly sandy loam. In some areas the surface layer is loam or fine sandy loam. In a few areas the slope is 6 to 15 percent. In places the lower part of the soil has a thin layer of sand and gravel.

Included with this soil in mapping are small areas of the moderately well drained Goodwit soils in areas where the surface deposit is silt loam, the somewhat poorly drained Moodig soils in swales and drainageways, and the well drained Sarona soils on the more sloping parts of the landscape. Also included are many small areas of very poorly drained organic soils in depressions, some areas where the surface soil is sandy and droughty, narrow areas that have steep slopes, areas where the water table is not seasonally perched in the subsoil, small areas where the subsoil has thin layers of silty deposits, and small very stony areas and ponds. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the Sarwet soil. Runoff is slow. The available water capacity is moderate. The content of organic matter in the surface layer and the potential for frost action also are moderate. The surface layer can be easily tilled throughout a wide range in moisture content, except in the small included areas that are very stony. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, but American basswood, northern red oak, eastern hemlock, and white ash are in most stands (fig. 19). The ground flora includes rosy twistedstalk, wild sarsaparilla, mapleleaf viburnum, Canada mayflower, beaked hazelnut, smooth yellow violet, sweet cicely, and ladyfern.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas.

If cultivated, this soil is subject to soil blowing during dry periods. Conservation tillage, field borders, field windbreaks, and vegetative row barriers help to control soil blowing and conserve moisture. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing and water erosion, improve fertility, and conserve the water available for plant growth.

This soil is suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, and pasture renovation help to keep the pasture in good condition.

Figure 19.—A stand of northern hardwoods, mostly sugar maple, in an area of Sarwet sandy loam, 2 to 6 percent slopes.

Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table. This limitation can be overcome by constructing a mound of suitable filtering material. In some areas the effluent can be pumped to an absorption field established on higher, better suited soils.

This soil is suited to dwellings without basements. It is only moderately suited to dwellings with basements because of the seasonal high water table, but basements can be constructed above the level of wetness.

Because of the risk of frost damage, this soil is only moderately suited to local roads. Frost action can be controlled by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is

ATM. The secondary habitat type commonly is AViO.

ScB—Sconsin silt loam, 1 to 6 percent slopes. This nearly level and gently sloping or undulating, moderately well drained soil is on knolls and low flats, in swales and drainageways in the uplands, and on the higher parts of glacial lake basins. The landscape is pitted in places. Areas are elongated or irregularly shaped and range from about 10 to 300 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 1 inch thick. The next layer is dark brown, dark yellowish brown, and brown silt loam and loam about 29 inches thick. It is mottled in the lower part. The subsoil is dark yellowish brown, mottled sandy loam about 4 inches thick. The substratum to a depth of about 60 inches is yellowish brown, stratified very gravelly sand and sand. In some areas the upper layers are loam. In a few areas the slope is 6 to 15 percent. In some places the substratum has thin layers of loamy deposits, and in a few places it is at a depth of more than 45 inches. It is cobbly in some areas. In places the upper silty deposits are more than 30 inches thick.

Included with this soil in mapping are small areas of the well drained Antigo soils on the higher parts of the landscape, the somewhat poorly drained Ossmer soils in swales and drainageways, and the moderately well drained Padwet soils in areas where the surface deposit is sandy loam. Also included are areas where loamy till is within a depth of 60 inches; small areas where the substratum is within a depth of 22 inches; areas where a water table is seasonally perched in the subsoil; narrow areas that have steep slopes; and small ponds, wet spots, very stony areas, depressions, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Sconsin soil and rapid or very rapid in the lower part. Runoff is slow or medium. The available water capacity is moderate. The content of organic matter in the surface layer and the potential for frost action also are moderate. The surface layer can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after rainfall. A mottled, seasonal zone of near saturation is at a depth of 2.5 to 3.5 feet. The rooting depth of some plants is limited by the sand and gravel substratum.

Most areas are used as woodland. The mature timber stands are mostly sugar maple, American basswood, and white ash, but yellow birch and black cherry are in most stands. The ground flora includes blue cohosh, sweet cicely, four-lined honeysuckle, smooth yellow violet, ladyfern, Virginia waterleaf, largeflowered bellwort, snow trillium, and bloodroot.

This soil is suited to trees. The main concern affecting woodland management is the equipment limitation. The use of equipment is restricted in the spring and in other excessively wet periods because of low soil strength. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. All-weather logging roads need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. Landings that are stabilized with gravel can better withstand the repeated use of heavy equipment.

After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is subject to water erosion in cultivated areas where the slope is more than 2 percent. Grassed waterways and a conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface help to prevent excessive soil loss. Some areas have long, smooth slopes that can be terraced and farmed on the contour. Diversions also help to control erosion in these areas. The substratum is droughty and may be difficult to vegetate if exposed during the construction of diversions, grassed waterways, or terraces. Land smoothing in nearly level areas can prevent the crop damage caused by ponding. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, regular additions of manure, and mulching increase the infiltration rate and the movement of air and water through the soil, improve fertility, help to prevent crusting and puddling of the surface layer, and conserve the water available for plant growth. They also help to prevent excessive water erosion in areas where the slope is more than 2 percent.

This soil is suited to pasture. A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is wet results in surface compaction, depletion of the plant cover, and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during wet periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing

with fertilizer helps to maintain a productive stand of forage.

This soil is poorly suited to septic tank absorption fields because of the rapid or very rapid permeability in the substratum and the seasonal zone of near saturation. These limitations can be overcome by constructing a mound of suitable filtering material. In some areas the effluent can be pumped to an absorption field established on higher, better suited soils.

This soil is suited to dwellings, but the substratum may cave in if it is excavated. Because of the risk of frost damage, the soil is only moderately suited to local roads. Frost action can be controlled by replacing the upper part of the soil with a coarse base material and by installing a good subsurface drainage system of adequate side ditches and culverts.

The land capability classification is IIe. Based on sugar maple productivity, the woodland ordination symbol is 3L. The primary habitat type commonly is AViO or ATM. The secondary habitat type commonly is AH.

VsB—Vilas-Sayner loamy sands, 1 to 6 percent slopes. These nearly level and gently sloping or undulating, excessively drained soils are on upland flats, on low swells or knolls, and on the sides of drainageways, kettles, and basins. The landscape is pitted in places. Areas are elongated or irregularly shaped and range from about 10 to several thousand acres in size. They generally are about 55 to 65 percent Vilas soil and 25 to 35 percent Sayner soil, but some areas are made up entirely of only one of the soils. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Vilas soil has a surface layer of very dark gray loamy sand about 2 inches thick. The subsurface layer is brown loamy sand about 1 inch thick. The subsoil is about 27 inches thick. It is dark reddish brown and dark brown loamy sand in the upper part and strong brown and yellowish brown sand in the lower part. The substratum to a depth of about 60 inches is light yellowish brown sand. In some areas the surface layer is sand. In a few areas the slope is 6 to 15 percent. In places the substratum is loamy sand. In a few places the soil has thin layers of gravelly sand, fine sand, very fine sand, or loamy fine sand.

Typically, the Sayner soil has a surface layer of very dark gray loamy sand about 2 inches thick. The subsurface layer is brown loamy sand about 3 inches thick. The subsoil is about 27 inches thick. It is dark reddish brown, reddish brown, and dark brown loamy sand in the upper part and brown gravelly sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas the surface layer is sand or gravelly loamy sand. In a few areas the slope is 6 to 15 percent. In places the substratum is sand, loamy sand, or gravelly loamy sand. In a few places the content of gravel in the soil is more than 35 percent.

Included with these soils in mapping are small areas of Au Gres, Croswell, Croswood, and Pence soils. The somewhat poorly drained Au Gres soils and the moderately well drained Croswell and Croswood soils are in swales and drainageways. Croswood soils have loamy till at a depth of 40 to 60 inches. The well drained Pence soils are in positions on the landscape similar to those of the Vilas and Sayner soils. They are sandy loam in the upper layers. Also included are areas where the soils have thin layers of loamy deposits; narrow areas that have steep slopes; and small ponds, wet spots, depressions, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is rapid in the Vilas soil. It is moderately rapid or rapid in the upper part of the Sayner soil and rapid or very rapid in the lower part. Runoff is very slow on both soils. The available water capacity and natural fertility are low. The content of organic matter in the surface layer is low or very low in the Vilas soil and low or moderately low in the Sayner soil. The surface layer of both soils can be easily tilled throughout a wide range in moisture content.

Most areas are used as woodland. The mature timber stands are mostly red maple, northern red oak, paper birch, eastern white pine, and red pine, but jack pine, balsam fir, and quaking aspen are in most stands. The ground flora includes blueberry, brackenfern, wintergreen, bigleaf aster, beaked hazelnut, grasses, barren strawberry, American starflower, wild sarsaparilla, blackberry, wild strawberry, and pipsissewa. Canada mayflower, yellow beadlily, and rosy twistedstalk are in the ground flora in areas of the more productive Sayner soil.

These soils are suited to trees. In areas of the Vilas soil, loose sand can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads and landings that are subject to the repeated use of heavy equipment can be stabilized with gravel, or they can be established in areas of the Sayner soil. Seedling survival during dry periods can be improved on these droughty soils by planting containerized seedlings or vigorous nursery stock when the soils are moist. Before trees are planted, site preparation by mechanical or chemical means may be needed to control competing vegetation.

These soils are suited to corn and small grain and to grasses and legumes for hay and pasture. Some areas

formerly used as cropland are now idle or have been planted to pine trees. Crop yields are generally limited because of the low available water capacity. Irrigation is necessary for dependable crop production. If cultivated, these soils are subject to soil blowing during dry periods. Field borders, field windbreaks, and vegetative row barriers help to control soil blowing. A conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface, cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure help to control soil blowing, improve fertility, and conserve the water available for plant growth. Additions of plant nutrients are needed because of the low natural fertility.

These soils are suited to pasture. They are droughty, however, and natural fertility is low. A cover of pasture plants is effective in controlling soil blowing. Overgrazing or grazing when the soils are dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during dry periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage. The response to additions of plant nutrients is limited, however, by the low available water content during dry periods.

These soils readily absorb but do not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water. The soils are suited to dwellings and to local roads. They may cave in if they are excavated. They are a probable source of sand or gravel.

The land capability classification is IVs. Based on red pine productivity, the woodland ordination symbol is 6A for the Vilas soil and 7A for the Sayner soil. The primary habitat type commonly is ArQV. The secondary habitat type commonly is PMV.

VsC—Vilas-Sayner loamy sands, 6 to 15 percent slopes. These sloping or rolling, excessively drained soils are on swells, hills, and ridges and on the sides of valleys, kettles, and basins. Areas are elongated or irregularly shaped and range from about 10 to several hundred acres in size. They generally are about 50 to 60 percent Vilas soil and 30 to 40 percent Sayner soil, but some areas are made up entirely of only one of the soils. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Vilas soil has a surface layer of black loamy sand about 3 inches thick. The subsurface layer is brown loamy sand about 1 inch thick. The subsoil is about 23 inches thick. It is dark brown loamy sand in the upper part and strong brown sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand. In some areas the surface layer is sand. In a few areas the slope is less than 6 percent. In places the substratum is loamy sand. In a few places the soil has thin layers of gravelly sand, fine sand, very fine sand, or loamy fine sand.

Typically, the Sayner soil has a surface layer of very dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 3 inches thick. The subsoil is about 22 inches thick. It is dark reddish brown and reddish brown loamy sand in the upper part and brown sand in the lower part. The substratum to a depth of about 60 inches is light yellowish brown, stratified gravelly sand and sand. In some areas the surface layer is sand or gravelly loamy sand. In a few areas the slope is less than 6 percent. In places the substratum is sand, loamy sand, or gravelly loamy sand. In a few places the content of gravel in the soil is more than 35 percent.

Included with these soils in mapping are small areas of the somewhat poorly drained Au Gres and moderately well drained Croswell soils in swales and drainageways and the well drained Pence soils. Pence soils are sandy loam in the upper layers. They are in positions on the landscape similar to those of the Vilas and Sayner soils. Also included are areas where loamy till is at a depth of 40 to 60 inches; areas where the soils have thin layers of loamy deposits; small areas where the slope is more than 15 percent; and small ponds, wet spots, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is rapid in the Vilas soil. It is moderately rapid or rapid in the upper part of the Sayner soil and rapid or very rapid in the lower part. Runoff is slow on both soils. The available water capacity and natural fertility are low. The content of organic matter in the surface layer is low or very low in the Vilas soil and low or moderately low in the Sayner soil.

Most areas are used as woodland. The mature timber stands are mostly red maple, northern red oak, paper birch, eastern white pine, and red pine, but jack pine, balsam fir, and quaking aspen are in most stands. The ground flora includes blueberry, brackenfern, wintergreen, bigleaf aster, beaked hazelnut, grasses, barren strawberry, American starflower, wild sarsaparilla, blackberry, wild strawberry, and pipsissewa. Canada mayflower, yellow beadlily, and rosy twistedstalk are in the ground flora on the more productive Sayner soil.

These soils are suited to trees. The slope limits the

selection of landing sites. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping. In areas of the Vilas soil, loose sand can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads and other areas that are subject to the repeated use of heavy equipment can be stabilized with gravel, or they can be established in areas of the Sayner soil. Seedling survival during dry periods can be improved on these droughty soils by planting containerized seedlings or vigorous nursery stock when the soils are moist. Before trees are planted, site preparation by mechanical or chemical means may be needed to control competing vegetation.

These soils are generally not suited to cultivated crops because of the low available water capacity and the low natural fertility. Some areas formerly used as cropland are now idle or have been planted to pine trees.

These soils are suited to pasture, but they are droughty. A cover of pasture plants is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the soils are dry results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, pasture renovation, and restricted use during dry periods help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage. The response to additions of plant nutrients is limited, however, by the low available water content during dry periods.

These soils readily absorb but do not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water. Because of the slope, the soils are only moderately suited to dwellings and local roads. The slope can be reduced by land shaping. Dwellings can be designed so that they conform to the natural slope of the land. The substratum is droughty and is difficult to vegetate if it is exposed by land shaping. The soils may cave in if they are excavated. They are a probable source of sand or gravel.

The land capability classification is VIs. Based on red pine productivity, the woodland ordination symbol is 6A for the Vilas soil and 7A for the Sayner soil. The primary habitat type commonly is ArQV. The secondary habitat type commonly is PVM.

VsD—Vilas-Sayner loamy sands, 15 to 35 percent slopes. These moderately steep or hilly to very steep, excessively drained soils are on hills and ridges and on the sides of valleys, kettles, and basins. Areas are long and narrow or irregularly shaped. They generally range from about 5 to 40 acres in size, but some are as large as several hundred acres. They generally are about 45 to 55 percent Vilas soil and 35 to 45 percent Sayner soil, but some areas are made up entirely of only one of the soils. The two soils commonly occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Vilas soil has a surface layer of black loamy sand about 3 inches thick. The subsurface layer is brown loamy sand about 1 inch thick. The subsoil is about 25 inches thick. It is dark reddish brown loamy sand in the upper part and dark brown and strong brown sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand. In some areas the surface layer is sand. In a few areas the slope is more than 35 percent. In places the substratum is loamy sand. In a few places the soil has thin layers of gravelly sand, fine sand, very fine sand, or loamy fine sand.

Typically, the Sayner soil has about 1 inch of partially decomposed leaf litter at the surface. The surface layer is brown loamy sand about 2 inches thick. The subsoil is about 26 inches thick. It is dark reddish brown loamy sand in the upper part and reddish brown and strong brown gravelly sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown, stratified gravelly sand and sand. In some areas the surface layer is sand or gravelly loamy sand. In a few areas the slope is more than 35 percent. In places the substratum is sand, loamy sand, or gravelly loamy sand. In a few places the content of gravel in the soil is more than 35 percent.

Included with these soils in mapping are small areas of the somewhat poorly drained Au Gres and moderately well drained Croswell soils in swales and drainageways and the well drained Pence soils. Pence soils are sandy loam in the upper layers. They are in positions on the landscape similar to those of the Vilas and Sayner soils. Also included are small areas where the soils have thin layers of loamy deposits; areas where loamy till is at a depth of 40 to 60 inches; small areas where the slope is less than 15 percent; and small ponds, wet spots, and gravel pits. Included areas make up less than 15 percent of the map unit.

Permeability is rapid in the Vilas soil. It is moderately rapid or rapid in the upper part of the Sayner soil and rapid or very rapid in the lower part. Runoff is medium on both soils. The available water capacity and natural fertility are low. The content of organic matter in the surface layer is low or very low in the Vilas soil and low or moderately low in the Sayner soil.

Most areas are used as woodland. The mature timber stands are mostly red maple, northern red oak,

paper birch, eastern white pine, and red pine, but jack pine, balsam fir, and quaking aspen are in most stands. The ground flora includes blueberry, brackenfern, wintergreen, bigleaf aster, beaked hazelnut, grasses, barren strawberry, American starflower, wild sarsaparilla, blackberry, wild strawberry, and pipsissewa. Canada mayflower, yellow beadlily, and rosy twistedstalk are in the ground flora on the more productive Sayner soil.

These soils are suited to trees. The main concerns affecting woodland management are the erosion hazard, the equipment limitation, and seedling mortality. Erosion results from the concentration of runoff on logging roads, skid trails, and landings. It can be minimized by logging, planting trees, and establishing roads and trails on the contour; yarding uphill by cable; and removing water by water bars, out-sloping road surfaces, and culverts. Drop structures may be needed to stabilize highly erodible areas. Seeding areas exposed by logging activities helps to establish a protective vegetative cover.

The slope limits the selection of sites for logging roads and landings. The roads can be established on the contour. Landings can be established on the better suited included or adjacent soils that are nearly level or gently sloping. Yarding the logs by cable and planting trees by hand may be needed in areas where the slope limits the use of equipment. In areas of the Vilas soil, loose sand can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads and other areas that are subject to the repeated use of heavy equipment can be stabilized with gravel, or they can be established in areas of the Sayner soil.

Seedling survival during dry periods, especially on the southern exposures, can be improved on these droughty soils by planting containerized seedlings or vigorous nursery stock when the soils are moist. Before trees are planted, site preparation by mechanical or chemical means may be needed to control competing vegetation.

These soils are generally not suited to farming because of the slope, the low available water capacity, the low natural fertility, and a severe hazard of erosion.

These soils are generally unsuited to septic tank absorption fields and dwellings mainly because of the slope. Overcoming this limitation is difficult. A better site, such as a small included area of a less sloping soil, should be selected.

These soils are poorly suited to local roads because of the slope. Land shaping is needed to reduce the slope, or the roads can be built on the contour. The substratum is droughty and is difficult to vegetate if exposed by land shaping. The soils may cave in if they are excavated. They are a probable source of sand or gravel.

The land capability classification is VIIs. Based on red pine productivity, the woodland ordination symbol is 6R for the Vilas soil and 7R for the Sayner soil. The primary habitat type commonly is ArQV. The secondary habitat type commonly is PMV.

WoA—Worcester sandy loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on low flats and in swales and drainageways in the uplands. The landscape is pitted in places. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are elongated or irregularly shaped and range from about 10 to 200 acres in size.

Typically, the surface layer is very dark gray sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 1 inch thick. The next layer is dark reddish brown, dark brown, and brown sandy loam about 17 inches thick. It is mottled in the lower part. The subsoil is about 19 inches thick. It is dark brown, mottled sandy loam in the upper part and strong brown gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas the surface layer is fine sandy loam. In a few areas the substratum has thin layers of loamy deposits, and in other areas it is loamy sand or gravelly loamy sand. In some places the substratum is at a depth of more than 45 inches.

Included with this soil in mapping are small areas of the very poorly drained Minocqua soils in depressions, the somewhat poorly drained Ossmer soils in areas where the surface deposit is silty, the moderately well drained Padwet soils on the higher parts of the landscape, and the somewhat poorly drained Worwood soils in areas where stratified lacustrine deposits are at a depth of 40 to 60 inches. Also included are areas where the substratum is within a depth of 24 inches; areas where the surface soil is loam or loamy sand; areas where loamy till is within a depth of 60 inches; narrow areas that have steep slopes; and small ponds, very stony areas, and sandy spots. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Worcester soil and rapid or very rapid in the lower part. Runoff is slow. The available water capacity is moderate. The content of organic matter in the surface layer is moderate or moderately low. The potential for frost action is high. The surface layer can be easily tilled throughout a wide range in moisture content. A seasonal high water table is at a depth of 0.5 foot to 2.0 feet. The rooting depth of some plants is limited by the seasonal high water table and, in places, by a

substratum of sand and gravel.

Most areas are used as woodland. The timber stands are mostly sugar maple, red maple, paper birch, quaking aspen, and balsam fir, but yellow birch and eastern hemlock are in most stands. The ground flora includes bunchberry dogwood, goldthread, smooth yellow violet, ladyfern, Canada mayflower, American starflower, rosy twistedstalk, wild sarsaparilla, beaked hazelnut, and yellow beadlily.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation and the windthrow hazard. The use of equipment is restricted in the spring and in other excessively wet periods because of the seasonal high water table and low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. Logging roads and landings that have a gravel base can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited. Adequate culverts are needed on graveled roads to maintain the natural drainage system.

A shallow rooting depth, which is caused by the high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. The high water table in undrained areas limits yields and the kinds of crops that can be grown. Field ditches and tile drains can lower the water table. Because the substratum is unstable and may cave, the sides of the ditches should be flattened and continuous tubing should be used when tile drains are installed. Filters are needed to keep the fine particles of sand in the substratum from clogging the drains. Drainage tile may be displaced by frost action. This displacement can be prevented by using continuous tubing or by installing the tile drains below the depth of freezing. The field ditches can be used as outlets for tile drains in areas where a suitable drainage outlet is not available.

If drained and cultivated, this soil is subject to soil blowing during dry periods. A conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface, field borders, field windbreaks, and vegetative row barriers help to control soil blowing. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure improve fertility and help to control soil blowing.

This soil is suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain unless the soil is drained. Excess water during wet periods may damage the forage. A cover of pasture plants is effective in controlling soil blowing. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, and pasture renovation help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing. Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the seasonal high water table and the risk of frost damage. These limitations can be overcome by adding a coarse base material to raise the roadbed above the level of wetness. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is 2W. The habitat type commonly is TMC.

WsA—Worwood loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on low terraces within or bordering the lower depressional areas and on the lower parts of glacial lake basins. The surface of the land commonly is uneven in wooded areas because of trees that have been uprooted by the wind. Areas are elongated or irregularly shaped and range from about 10 to 100 acres in size.

Typically, the surface layer is very dark gray loam about 3 inches thick. The subsurface layer is dark grayish brown, mottled gravelly sandy loam about 1 inch thick. The upper part of the subsoil is dark brown, mottled gravelly sandy loam about 7 inches thick. The next layer is dark brown and brown, mottled sandy loam about 13 inches thick. The lower part of the subsoil is dark brown, mottled gravelly sandy loam about 10 inches thick. The upper part of the substratum is brown, mottled gravelly coarse sand about 8 inches thick. The lower part to a depth of about 60 inches is mostly

mottled strata of gray silt loam and reddish brown very fine sandy loam. In some areas the surface layer is sandy loam, fine sandy loam, or very fine sandy loam. In a few areas the lower part of the substratum is mostly stratified fine sand and loamy fine sand. In places the lower part of the substratum is within a depth of 40 inches, and in a few areas it is loamy glacial till or contains strata of gravelly or very gravelly sand.

Included with this soil in mapping are small areas of very poorly drained soils in depressions, the moderately well drained Padwood and well drained Padus soils on the higher parts of the landscape, and the somewhat poorly drained Worcester soils in areas where the underlying deposit is sand and gravel to a depth of at least 60 inches. Padus soils have a substratum of sand and gravel to a depth of about 60 inches. Also included are areas where the substratum is within a depth of 24 inches, narrow areas that have steep slopes, areas where the surface soil is loamy sand, and small ponds. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the Worwood soil. It is rapid or very rapid in the upper part of the substratum and moderately slow in the lower part. Runoff is slow. The available water capacity is moderate. The content of organic matter in the surface layer also is moderate. The potential for frost action is high. The surface layer can be easily tilled throughout a wide range in moisture content. A perched seasonal high water table is at a depth of 0.5 foot to 2.0 feet. The rooting depth of some plants is limited by the perched seasonal high water table and, in places, by sand and gravel in the upper part of the substratum.

Most areas are used as woodland. The timber stands are mostly sugar maple, red maple, paper birch, quaking aspen, and balsam fir, but yellow birch and eastern hemlock are in most stands. The ground flora includes bunchberry dogwood, goldthread, smooth yellow violet, ladyfern, Canada mayflower, American starflower, rosy twistedstalk, wild sarsaparilla, beaked hazelnut, and yellow beadlily.

This soil is suited to trees. The main concerns affecting woodland management are the equipment limitation, seedling mortality, and the windthrow hazard. The use of equipment is restricted in the spring and in other excessively wet periods because of the seasonal high water table and low soil strength. Ruts form if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soil is dry or when the ground is frozen. Logging roads and landings that have a gravel base can better withstand the repeated use of heavy equipment. Also, the landings can be established on adjacent or included soils that are better suited. Adequate culverts are needed on graveled roads to maintain the natural drainage system.

The seedling mortality resulting from soil wetness can be reduced by planting vigorous nursery stock on the crest of cradle-knolls or on prepared ridges. A shallow rooting depth, which is caused by the perched high water table, can result in windthrow of some trees during periods of strong winds and excessive wetness. Windthrow can be minimized by using harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent the natural regeneration of desirable tree species. Special harvest methods may be needed to control the competing plants. Before trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of invading species may be needed.

If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. The high water table in undrained areas limits yields and the kinds of crops that can be grown. Field ditches and tile drains can lower the water table. Because the substratum is unstable and may cave, the sides of the ditches should be flattened and continuous tubing should be used when tile drains are installed. Filters are needed to keep the fine particles of silt and sand in the substratum from clogging the drains. Drainage tile may be displaced by frost action. This displacement can be prevented by using continuous tubing or by installing the tile drains below the depth of freezing. The field ditches can be used as outlets for tile drains in areas where a suitable drainage outlet is not available.

If drained and cultivated, this soil is subject to soil blowing during dry periods. A conservation tillage system, such as chisel plowing, that leaves all or part of the crop residue on the surface, field borders, field windbreaks, and vegetative row barriers help to control soil blowing. Cover crops, green manure crops, crop residue management, grasses and legumes in the crop rotation, and regular additions of manure improve fertility and help to control soil blowing.

This soil is suited to pasture. Alfalfa stands for improved pasture are difficult to establish and maintain unless the soil is drained. Excess water during wet periods may damage the forage. A cover of pasture plants is effective in controlling soil blowing. Overgrazing results in depletion of the plant cover and the growth of undesirable plant species. Proper stocking rates, rotation grazing, and pasture renovation help to keep the pasture in good condition. Clipping or mowing the pasture controls weeds and brush and results in a more uniform pattern of regrowth and grazing.

Topdressing with fertilizer helps to maintain a productive stand of forage.

This soil is generally unsuited to septic tank absorption fields and dwellings mainly because of the seasonal high water table. This limitation is difficult to overcome. A better site should be selected.

This soil is poorly suited to local roads because of the seasonal high water table and the risk of frost damage. These limitations can be overcome by adding a coarse base material to raise the roadbed above the level of wetness. A good subsurface drainage system of adequate side ditches and culverts is needed.

The land capability classification is IIw. Based on red maple productivity, the woodland ordination symbol is 3W. The habitat type commonly is TMC.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 276,800 acres in the survey area, or nearly 49 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the southern and western parts, mainly in associations 1, 2, 3, 5, and 6, which are described under the heading "General Soil Map Units." About 44,000 acres of this prime farmland is currently used for crops, mainly hay, oats, and corn.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify as prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

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Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various land uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils as woodland; for crops and pasture; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the suitability and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Woodland Management and Productivity

Ole Hanson, forest administrator, Lincoln County, and Jeff Barkley, forester, Wisconsin Department of Natural Resources, helped prepare this section.

Forest resources have long been of major importance in Lincoln County. In 1852, about 92 percent of the land area in the county was forested. These original forests, however, have been altered by logging, fires, and agricultural activities. By 1920, most of the original timber crop of hardwoods and conifers was harvested. The largest fire occurred in 1933. It destroyed about 90,000 acres of forest in the western part of the county. By 1950, about 125,600 acres of woodland had been converted to cropland and other farm uses, mostly in the southeastern part of the county.

About 411,200 acres in Lincoln County was forested in 1983, including about 393,800 acres of commercial forest (USDA, 1983). The acreage of commercial forest has decreased slightly since 1968. Nearly 40 percent of the forested acreage is owned by the forest industry or is publicly owned. The rest is owned by farmers and other private individuals and corporations. The commercial forest land includes about 306,500 acres of upland woods. The rest is wooded swamps.

The composition of the upland woods is variable, primarily because of the differences in fertility and available water capacity of the soils. The mature timber stands are mostly sugar maple, American basswood, white ash, yellow birch, black cherry, and eastern hophornbeam in areas of silty upland soils, where fertility is high and the available water capacity is moderate or high. Antigo, Crystal Lake, Freeon, Goodman, Goodwit, Mequithy, and Sconsin soils are examples of silty upland soils. The timber stands also include red maple, eastern hemlock, northern red oak, and paper birch in areas of loamy upland soils, where fertility and the available water capacity are generally lower than in the silty soils. The loamy soils include Newood, Newot, Padus, Padwet, Padwood, Sarona, and Sarwet soils. On the somewhat poorly drained soils, red maple is commonly a larger component of the mature timber stands than sugar maple. Aspen and balsam fir also are major components of stands on these wetter soils. American hornbeam typically grows on the somewhat poorly drained soils that are silty, such as Magnor soils. On fertile soils, stands of aspen, balsam fir, and paper birch are on steep, north-facing slopes and in areas that are managed for these

Figure 20.—A typical area of upland woods, dominated by eastern white pine, in an area of the droughty, infertile Vilas soils.

species. Young, even-aged stands are mostly aspen and birch. These tree species also predominate on a large acreage in the western part of the county that was burned in 1933.

The upland woods in areas of droughty, infertile soils, such as Croswell, Croswood, Sayner, and Vilas soils, are mostly red maple, paper birch, northern red oak, aspen, balsam fir, eastern white pine, red pine, and jack

pine (fig. 20). These drought-tolerant species also are in timber stands on the moderately fertile Keweenaw and Pence soils, which have a low available water capacity. On these soils, paper birch predominates on the south and west exposures.

The wooded swamps are on poorly drained and very poorly drained soils along drainageways and in depressions throughout the county (fig. 21). They commonly support stands of balsam fir, black ash, black spruce, northern whitecedar, tamarack, red maple, aspen, and American elm. Many stands are mostly swamp conifers. Silver maple, paper birch, yellow birch, and eastern hemlock are in some stands.

Composition of the forest land by forest type in 1983 was 6 percent pine; about 14 percent spruce, fir, and other lowland conifers; about 9 percent elm, ash, and other lowland hardwoods; about 1 percent oak; about 32 percent maple, birch, and other upland hardwoods; and 38 percent aspen and birch (USDA, 1984). The trend is toward more pine and lowland hardwoods and fewer oak and lowland conifers. The amount of maple, birch, and aspen has remained relatively stable.

Composition of the forest land by stand-size class in 1983 was 16 percent sawtimber, 50 percent poletimber, and 34 percent seedlings and saplings. The sawtimber was mostly aspen, pine, and maple. The poletimber, seedlings, and saplings were mostly aspen and maple. The trend is toward more sawtimber and poletimber and fewer seedlings and saplings.

In 1983, growing stock had a volume of about 4,326,380 cords, which represented an 11 percent increase since 1968. In 1982, the annual growth was about 157,900 cords, which exceeded removal by about 46,400 cords. In that year, the growth of growing stock exceeded removal for all tree species, except aspen and elm. In 1983, aspen was the highest volume species, followed by maple, pine, birch, spruce fir, balsam fir, ash, basswood, oak, and other species. The trend is toward an increase in the volume of most species, except for ash, basswood, and elm. Since 1968, pine, maple, spruce fir, and balsam fir have had the highest increases in volume.

In 1983, sawtimber had a volume of about 537,299,000 board feet, which represented a 4 percent decrease since 1968. In 1982, the annual growth was 28,128,000 board feet, which exceeded removal by 5,067,000 board feet. In that year, the growth of sawtimber exceeded removal for all tree species, except for aspen, elm, maple, and oak. In 1983, aspen sawtimber had the highest volume, followed by pine, maple, spruce fir, balsam fir, ash, elm, oak, basswood, birch, and other species. The trend is toward an increase in the volume of aspen, spruce fir, balsam fir, oak, and birch and a decrease in the volume of other species.

Management for wood crops on the soils in Lincoln County varies. It should be based on the species in the stand, the suitability of the soils for the species, and the objectives of the landowners. The best alternative generally is selective harvesting that favors most hardwood species or even-aged management that favors any aspen or birch species (fig. 22). Even-aged management that favors pine species and northern red oak is desirable if the stands have significant amounts of these species. Clear-cut areas commonly regenerate to mostly tag alder on very poorly drained soils. Management on the wetter soils can favor northern whitecedar for posts and piles or balsam fir for pulpwood.

Management should include controlling erosion, overcoming soil-related equipment limitations, improving the seedling survival rate, minimizing the windthrow of trees on the wetter sites, controlling the growth of competing vegetation, planting trees where natural regeneration is unreliable, harvesting in a timely manner, controlling damage by insects and diseases, removing cull trees and undesirable species, maintaining the most productive basal area, preventing woodland fires, and excluding livestock from the woodland. Management of public lands for maximum timber production is generally tempered by recreational concerns and by considerations of wildlife management, including the kinds of trees that are best suited to habitat for wildlife.

The paragraphs that follow describe the main concerns in managing the woodland in the county. These concerns are erosion, low soil strength, wetness, soil productivity, slope, stoniness, rock outcrops, and droughtiness.

Erosion can occur as a result of site preparation and cutting if the soil is exposed along logging roads and skid trails and on landings. Burned or overgrazed areas also are subject to erosion. Erosion generally is a hazard on forest land if the slope is 15 percent or more. About 10 percent of the commercial forest land in Lincoln County is susceptible to erosion, including areas of Newot soils and some areas of Keweenaw, Padus, Pence, Sarona, Sayner, and Vilas soils. Excessive soil loss can be prevented by logging, planting trees, and establishing roads and trails on the contour; yarding uphill by cable; removing water with water bars, out-sloping road surfaces, and culverts; preventing fires; and excluding livestock from the woodland. Drop structures may be needed to stabilize highly erodible areas. Seeding areas exposed by logging activities helps to establish a protective vegetative cover.

Figure 21.—A typical wooded swamp in an area of the very poorly drained Lupton soils.

Low soil strength can restrict the use of equipment on upland soils during the spring thaw and other excessively wet periods. Upland soils that have a moderate or high content of silt, including Antigo, Crystal Lake, Freeon, Goodman, Goodwit, Mequithy, Newood, Newot, Padus, Padwet, Padwood, Sarona, Sarwet, and Sconsin soils, have low strength during wet periods. Ruts form if wheeled vehicles are used when these soils are wet (fig. 23). Deep ruts tend to restrict lateral drainage and result in damage to tree roots. Equipment should be used only when the soils are not too wet or when the ground is frozen. On the very silty soils, such as Antigo, Crystal Lake, Freeon, Goodman, Goodwit, Mequithy, and Sconsin soils, all-weather roads

need a gravel base because unsurfaced roads are slippery and easily rutted during wet periods. On these soils, landings that are stabilized with gravel can better withstand the repeated use of heavy equipment.

Soil wetness is the result of a high water table, flooding, or ponding. It can be a problem in forested areas of very poorly drained, poorly drained, and somewhat poorly drained soils. Wetness can cause seedling mortality on some of the soils and can limit the use of equipment and increase the windthrow hazard. It also increases the extent of the vegetation that competes with tree regeneration.

Seedling mortality is a hazard on about 35 percent of the commercial forest land in Lincoln County. The mortality rate can be high on the poorly drained and very poorly drained soils. It also is a problem on the somewhat poorly drained Au Gres, Augwood, Pesabic, and Worwood soils and in some areas of the somewhat poorly drained Comstock, Hatley, Magnor, Magroc, and Ossmer soils where water accumulates in the swales between cradle-knolls. Seedling survival rates can be increased by planting vigorous nursery stock on prepared ridges or on the crest of cradle-knolls. Where mechanical tree planters cannot be used because of wetness during the planting season, hand planting of trees is necessary if natural tree regeneration is

Figure 23.—Ruts in an area of Sarwet soils. Ruts can form easily if wheeled forestry equipment is used during wet periods.

unreliable. Plantings on the wetter sites should include spruce and tamarack.

The use of equipment on poorly drained and very poorly drained soils is generally limited to periods during the winter when the ground is frozen. On the somewhat poorly drained soils, especially silty soils, using equipment only when the soils are not too wet or when the ground is frozen helps to prevent the formation of ruts. On these soils, logging roads and landings that have a gravel base can better withstand

the repeated use of heavy equipment. Also, the landings can be established on suitable adjacent soils that are better drained. Culverts are needed along graveled roads to maintain the natural drainage system.

Trees are shallow rooted in areas where the water table is near the surface. They can be blown down by strong winds during periods of excessive wetness. Windthrow can be a problem on about 54 percent of the commercial forest land in Lincoln County. A harvest method, such as a shelter-wood cut, that does not leave the remaining trees widely spaced can minimize the windthrow of trees. This method of harvesting also helps to ensure the natural regeneration of trees by controlling the extent of competing vegetation.

Soil productivity is so high on about 87 percent of the forested areas in the county that the growth of undesirable plants is a problem if harvesting creates openings in the tree canopy. Competition from unwanted plants can delay or prevent natural regeneration of the desired tree species and can hinder the establishment of planted trees. Plant competition is more severe on the wetter soils than on other soils. It can be controlled by selective cutting that maintains most of the tree canopy, by establishing the new forest soon after harvesting, or by removing the undesirable plants with herbicides. In areas where equipment can be used, the unwanted plants can be removed by machinery. Skidding may expose enough soil for adequate regeneration. Before trees are planted, site preparation by mechanical or chemical means generally is needed to control competing vegetation. Subsequent control of invading species may be needed on the more fertile soils, especially in the wetter areas.

Slope, stoniness, and rock outcrops can limit the use of forestry equipment. Slope is a problem in areas where it is 15 percent or more. Surface stones and bedrock outcrops also interfere with the use of equipment. Stones are common in some areas of soils that formed wholly or partly in glacial till. Rock outcrops are common in some areas of Magroc and Mequithy soils. Trees should be planted by hand and yarded with a cable in areas where the slope, stones, or rock outcrops prohibit the use of equipment. Building logging roads on the contour helps to maintain a low grade. Roads and landings can be established in the less sloping areas. In areas of Mequithy soils, the excavation of deep cuts and road ditches is restricted by the underlying bedrock.

Soil droughtiness can cause seedling mortality. The steeper, south- or west-facing slopes are especially droughty because of high soil temperatures and a high evaporation rate. Droughtiness is a problem in areas of Croswell, Croswood, Keweenaw, Pence, Sayner, and Vilas soils and in hilly to very steep areas of Newot and Sarona soils that face south or west. If natural regeneration is unreliable, seedling survival during dry periods can be improved by planting containerized seedlings or vigorous nursery stock during periods when the soil is moist. Reinforcement planting may be needed on very dry sites.

Tables 6 and 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. Table 6 lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 6, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the upper 20 inches, depth to a seasonal high water table, rock fragments in the upper 20 inches, effective rooting depth, and slope aspect. A rating of

slight indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production. Additional information about these trees is available in the local office of the Natural Resources Conservation Service.

Table 7 gives information about operating forestry equipment on logging areas, skid trails, log landings, and haul roads and in site preparation and planting, which includes row seeding. Limitations are given for the most limiting season, which generally is spring in Lincoln County. The limitations can also apply, however, during other excessively wet periods, such as after a heavy rainfall. The preferred operating season is the period when the use of forestry equipment causes the least amount of soil damage. This period generally is when the soil is not too wet or when the ground is frozen.

In table 7, the equipment limitations reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland harvesting and regeneration activities. The chief characteristics and conditions considered in the ratings are soil wetness, the hazard of flooding, rock outcrops, stones on the surface, texture of the surface layer, slope, depth to hard bedrock, the traffic-supporting capacity (or soil strength), and the potential for frost action. Soils that have a moderate or high content of silt have low strength in the extended spring thaw period and during extended periods of high rainfall. Ruts can form easily in areas of these soils during these wet periods.

The ratings of *slight, moderate,* or *severe* in the table are based on the use of conventional equipment and procedures. Special procedures or types of equipment can sometimes be utilized to reduce or overcome the site limitations. If wetness is a limitation, for example, the use of high flotation equipment may prevent the formation of ruts. Restrictions on the use of equipment indicate the need for choosing the right equipment to be used and the need for accurate timing of operations to avoid seasonal limitations. The cost of operations generally increases as the limitations become more severe. The ratings for log landings and haul roads can be used as a guide for establishing them in the least costly locations.

Logging areas and skid trails include areas where some or all of the trees are being cut. Generally, equipment traffic is least intensive in the logging areas. Skid trails, which generally are within the logging area, are roads or trails over which the logs are dragged or hauled from the stump to a log landing. A rating of slight indicates that the use of conventional equipment

is not normally restricted by the physical site conditions. A rating of moderate indicates that the use of equipment or season of use is restricted because of one or more soil factors. A rating of severe indicates that special equipment or techniques are needed to overcome the limitations or that the time of efficient operation is very limited.

Log landings are areas where logs are assembled for transportation (fig. 24). Wheeled equipment may be used more frequently in these areas than in any other areas affected by logging. Considerable soil compaction can be expected in these areas. Good areas for landings require little or no surface preparation or cutting or filling. A rating of slight indicates that the soil is a good site for landings and the area can readily be returned to forest use. A rating of moderate indicates that the season of use is somewhat limited or that practices such as grading, cutting, filling, or drainage are usually required to make the site suitable for a landing and returning the site to forest use is difficult. A rating of severe indicates that the season of use is very limited or that special or expensive techniques are needed to overcome the limitations. There may also be significant risk of environmental damage that makes it very difficult or impossible to return the area to forest use.

Haul roads are access roads leading from log landings to primary or surfaced roads. The haul roads serve as transportation routes for wheeled logging equipment. Generally, they are unpaved roads and are not graveled. The wetter soils and the silty upland soils, which are slippery and easily rutted during wet periods, commonly provide poor locations for haul roads. A rating of slight indicates that no serious limitations affect the location, construction, and maintenance of haul roads or the season of use. A rating of moderate indicates some limitations, but the limitations generally can be overcome with routine construction techniques. A rating of severe indicates that it is difficult and expensive to establish and maintain haul roads on the soil or that the season of use may be severely restricted.

Site preparation and planting are the mechanized operations for establishing planted trees in an area. The ratings are based on limitations that affect the efficient use of equipment and the risk of damage to the site caused by the equipment. Operating techniques should not displace or remove topsoil from the site or create channels that concentrate storm runoff. A rating of slight indicates that no serious limitations affect site preparation and planting. A rating of moderate indicates that the site conditions prevent the efficient use of the equipment or that the site may be damaged by the equipment. A rating of severe indicates that special equipment or techniques, such as hand planting of trees, are needed to overcome the limitations.

Additional information about woodland management and productivity can be obtained from the Wisconsin Department of Natural Resources, the local office of the Natural Resources Conservation Service, or the Cooperative Extension Service.

Forest Habitat Types

John Kotar, research scientist, Department of Forestry, University of Wisconsin-Madison, helped prepare this section.

The forest habitat type system used in Lincoln County is derived from a field guide developed for northern Wisconsin (Kotar and others, 1988). The system of habitat classification is based on the concept that plants, including trees, normally occur in predictable patterns or communities and that these communities reflect differences in site characteristics, primarily the moisture content and fertility of the soils. A forest habitat type is an association of dominant tree and ground flora species in a climax plant community. It encompasses all soils capable of producing similar plant communities at climax, which is the stage in ecological development when the vegetative community becomes stable and perpetuates itself.

A habitat type can be identified during most stages of successional growth by examining the reproductive success of various tree species and by inspecting the ground flora, which becomes relatively stable soon after the establishment of a forest canopy. In a young forest, the patterns or associations of understory plants can be used to predict the dominant tree species in the climax forest.

The successional stages and trends also are predictable for the various habitat types. This predictability allows forest managers to make accurate prescriptions for manipulating vegetation based on the ecological potential of the soil rather than on the current forest cover type, which can vary depending largely on how the forest has been disturbed. Additional management implications for each habitat type are in the "Field Guide to Forest Habitat Types of Northern Wisconsin" (Kotar and others, 1988).

Habitat types have been determined for most of the soils in Lincoln County. They are specified at the end of each map unit description in the section "Detailed Soil Map Units." Although soil map units do not coincide exactly with habitat types, there is a strong correlation between them. Some map units encompass two ecologically different habitat types. The assigned habitat types may be different in some small areas included in mapping.

The following paragraphs describe the habitat types

Figure 24.—A log landing in an area of Sarona soils.

in the county. The names are derived from the potential climax vegetation on a site. They represent a combination of tree species, which are listed first, and ground flora species. The descriptions provide information about the potential climax tree species, some of the common understory species, and the local soils that support each habitat type. The current plant communities in mature forests on the different map units are described in the section "Detailed Soil Map Units."

AH—Acer/Hydrophyllum habitat type. The common name is sugar maple/Virginia waterleaf. This habitat type has a potential climax overstory dominated by sugar maple. The dominant ground flora consists of grass, sedge, sugar maple seedlings, Virginia waterleaf, sweet cicely, smooth yellow violet, downy yellow violet, snow trillium, bloodroot, ladyfern, spinulose woodfern, and nettle. This habitat type is in areas of Antigo, Crystal Lake, Freeon, Goodman, Goodwit, Mequithy, and Sconsin soils. A wet phase, where red maple is more common than sugar maple, is in areas of Comstock, Hatley, Magnor, Magroc, and Ossmer soils that have a seasonal high water table (fig. 25).

AViO—Acer/Viola-Osmorhiza habitat type. The

common name is sugar maple/yellow violet-sweet cicely. This habitat type has a potential climax overstory dominated by sugar maple. The dominant ground flora consists of grass, sedge, sugar maple seedlings, sweet cicely, smooth yellow violet, downy yellow violet, snow trillium, bloodroot, ladyfern, spinulose woodfern, solomon's seal, rosy twistedstalk, and Canada mayflower. This habitat type is in areas of Antigo, Crystal Lake, Freeon, Goodman, Goodwit, Mequithy, Padwood, Padus, Sarona, and Sconsin soils. It is also

Figure 25.—A typical site of a wet phase of the AH habitat type in an area of Comstock soils. The overstory is mostly northern hardwoods dominated by red maple and sugar maple.

in areas of the Comstock, Hatley, Magnor, Magroc, Ossmer, Padwet, and Sarwet soils that have a seasonal high water table. In these wetter areas, red maple is more common than sugar maple.

ArQV—Acer-Quercus/Vaccinium habitat type. The common name is red maple-northern red oak/blueberry. This habitat type has a potential climax overstory dominated by red maple, northern red oak, and eastern white pine. The dominant ground flora consists of brackenfern, blueberry, hazelnut, grass, sedge, wintergreen, Canada mayflower, bigleaf aster, and serviceberry. This habitat type is in areas of Croswell and Vilas soils.

ATM—Acer-Tsuga/Maianthemum habitat type. The common name is sugar maple-eastern hemlock/Canada mayflower. This habitat type has a potential climax overstory dominated by sugar maple, eastern hemlock, and yellow birch. The dominant ground flora consists of grass, sedge, sugar maple seedlings, wild sarsaparilla, hazelnut, Canada mayflower, spinulose woodfern, and ladyfern. This habitat type is in areas of Newood, Newot, and Pence soils. A viola phase, where smooth yellow violet and sweet cicely are in the ground flora, is in areas of Padus, Padwet, Padwood, Sarona, and Sarwet soils.

AVVb—Acer/Vaccinium-Viburnum habitat type. The common name is sugar maple/blueberry-mapleleaf viburnum. This habitat type has a potential climax overstory dominated by sugar maple, red maple, and northern red oak. The dominant ground flora consists of grass, sedge, hazelnut, bigleaf aster, mapleleaf viburnum, wild sarsaparilla, brackenfern, and sugar maple and eastern hophornbeam seedlings. This habitat type is in areas of Keweenaw soils.

PMV—Pinus/Maianthemum-Vaccinium habitat type. The common name is eastern white pine/Canada mayflower-blueberry. This habitat type has a potential climax overstory dominated by eastern white pine, balsam fir, white spruce, red maple, and northern red oak. The dominant ground flora consists of brackenfern, hazelnut, grass, sedge, Canada mayflower, bigleaf aster, blueberry, wintergreen, and red maple seedlings. This habitat type is in areas of Croswood and Sayner soils.

TMC—Tsuga/Maianthemum-Coptis habitat type. The common name is eastern hemlock/Canada mayflower-goldthread. This habitat type has a potential climax overstory dominated by eastern hemlock, red maple, sugar maple, and yellow birch. The dominant ground flora consists of grass, sedge, spinulose woodfern, Canada mayflower, yellow beadlily, sugar maple and red maple seedlings, hazelnut, wild sarsaparilla, bunchberry dogwood, and goldthread. This habitat type is in areas of Moodig, Pesabic, Worcester, and Worwood soils. A vaccinium phase (TMC-V), where blueberry is common, is in areas of the Au Gres and Augwood soils.

Crops and Pasture

John Pingry, agronomist, Natural Resources Conservation Service, and Tom Cadwallader, agricultural agent, University of Wisconsin Extension Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

In 1987, about 61,900 acres in Lincoln County was used for crops and pasture (U.S. Department of Commerce, 1989). An additional 9,500 acres was grazed woodland. About 13,950 acres was pasture, including about 5,800 acres of permanent pasture. About 18,900 acres of the harvested cropland was used for alfalfa hay, 9,500 acres for other hay, 6,600 acres for oats, 5,900 acres for corn, and 1,600 acres for barley (Wisconsin Department of Agriculture, 1988). Small acreages were used for snap beans, soybeans, wheat, peas, sweet corn, ginseng, raspberries, strawberries, cranberries, apples, and nursery plants.

A large part of the cropland is used for the production of forage hay, oats, and corn to support the dairy industry. The hay crop in the southern part of the county is mostly a mixture of timothy and red clover because many of the soils, such as Magnor soils, are generally too wet to support good stands of alfalfa. Alfalfa is commonly sown with the red clover, however, because reliable stands of alfalfa can be maintained in dry years, especially on the higher, more sloping parts of the hay fields. The hay crop is commonly a mixture of bromegrass and alfalfa in areas where the soils are well drained.

The acreage used for hay has remained relatively stable for many years. Since 1983, however, the acreage of alfalfa hay has increased and that of other kinds of hay has decreased. The acreage used for oats and wheat has remained stable. In recent years, the acreage used for barley has increased and that used for

corn, soybeans, peas, sweet corn, and snap beans has decreased.

The soils in Lincoln County vary in their suitability for specialty crops. Special, more intensive management commonly is needed if specialty crops are grown. Management for ginseng production is an example. It includes not only the basic management techniques used for the commonly grown crops but also extensive applications of fungicide and insecticide. Nearly level, well drained, fertile soils that have a high available water capacity are especially well suited to ginseng, sweet corn, snap beans, peas, and soybeans. Sandy soils, such as Croswell, Croswood, Vilas, and Sayner soils, and other soils that have good tilth but a low available water capacity are suited to strawberries. Most of the well drained soils in the county are suited to small fruits, tree fruits, and nursery plants. Soils in low positions where frost is more frequent are poorly suited to vegetables, small fruits, and tree fruits. The organic soils in low positions, however, have potential for mint, cranberries, and sod for lawns.

The latest information about growing specialty crops can be obtained from the local office of the Cooperative Extension Service.

The soils in Lincoln County have good potential for increased production of farm crops. If proper conservation measures are applied, more than 250,000 acres of forested land, including more than 170,000 acres of prime farmland, could be cleared and used for crop production. Also, a large acreage of nearly level and gently sloping, sandy soils in the north-central part of the county could be converted to irrigated crops, such as potatoes. The area has ample water supplies for irrigation. Forage production could be increased throughout the county if the wet soils were drained and used for alfalfa instead of forage grasses or red clover. Food production also could be increased considerably by applying the latest crop production technology to all of the cropland in the county. This soil survey can greatly facilitate the application of such technology.

Management varies on the different kinds of soil in Lincoln County. Basic management, however, is needed on practically all of the soils. It includes controlling erosion; providing an adequate drainage system; maintaining fertility; maintaining or improving tilth; preparing a good seedbed; and timely planting, harvesting, and pest-control measures. Basic management of pasture includes proper stocking rates; rotation grazing; pasture renovation; clipping or mowing, which removes weeds and brush and encourages uniform regrowth and grazing; and restricted use during periods when the soil can be damaged by grazing. Crop yields and the kinds of crops that can be grown are limited by the frost hazard, a short growing season, and cool temperatures.

The paragraphs that follow describe the main concerns in managing the cropland and pasture in the county. These concerns are water erosion, soil blowing, drainage, fertility, and tilth.

Water erosion is generally a hazard in areas where the slope is more than 2 percent. About 66 percent of the acreage in Lincoln County is wholly or partly susceptible to water erosion. Most of this acreage, however, currently has a protective cover of vegetation. Erosion is a problem in areas where erodible soils are used for row crops.

Erosion is damaging for three reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a layer in or below the subsoil that limits the depth of the root zone. Such layers include the strata of gravel in Antigo soils, the bedrock in Mequithy soils, and the firm substratum in Freeon soils. Vilas, Sayner, and other sandy soils are damaged when erosion exposes infertile sand or gravel. Second, erosion adversely affects tilth and the infiltration of water. Eroded soils are generally more difficult to till than uneroded soils because the content of clay in the plow layer usually increases when part of the subsoil is incorporated into the plow layer. Third, erosion results in sediments entering lakes and streams. Control of erosion helps to prevent this sedimentation and improves the quality of water for municipal and recreational uses and for fish and other wildlife.

Erosion-control measures provide a protective cover, help to control runoff rates, increase the rate of water infiltration, and divert runoff from critical areas. A cropping system that keeps a plant cover on the soil for extended periods can hold erosion to a level that does not reduce the productive capacity of the soil. Including grasses and legumes in the cropping sequence helps to control erosion and improves tilth. The legumes also provide nitrogen for the following crop.

A conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface, cover crops, green manure crops, crop residue management, grasses and legumes in the cropping sequence, regular additions of manure, and mulching increase the rate of water infiltration and reduce the runoff rate and the susceptibility to erosion. These practices are suited to all erodible soils in the county. Plowing in the spring instead of the fall also is effective in controlling erosion. Fall plowing leaves the surface layer exposed to erosion damage caused by spring runoff.

Terraces and diversions reduce the length of slopes and direct runoff away from critical areas, thus reducing the amount of runoff and erosion. Diversions also help to protect low areas from the runoff from higher areas. Terraces and diversions are most practical on very deep, well drained soils that have long and uniform slopes. If they are used on the wetter soils, such as Magnor soils, establishing a slight grade towards grassed waterways helps to remove excess surface water. Some of the soils in the county are generally not suited to terraces and diversions because of short slopes, irregular slopes, excessive wetness in channels, shallowness to bedrock, or infertile sand and gravel, which would be exposed in the channels. On these soils, a cropping system that provides an adequate cover of plants or residue is needed to control erosion.

Grassed waterways remove excess surface water and reduce the risk of erosion on erodible slopes along natural drainageways. They are most practical on very deep, well drained soils. Some grassed waterways are tiled, which reduces wetness in channels. As a result, farm machinery can more easily cross the channels and a plant cover can be more easily established. Establishing grassed waterways is difficult on some soils because of excessive wetness in channels or because of bedrock or infertile sand and gravel, which would be exposed in the channels.

Contour farming and contour stripcropping help to control erosion on soils that have long and uniform slopes. They allow for more intensive cropping of erodible soils by reducing the runoff rate and the risk of erosion. If they are used on the wetter soils, such as Magnor soils, establishing a slight grade towards grassed waterways helps to remove excess surface water. Contour farming and contour stripcropping are not practical in many areas of the county because the slopes are too short or irregular.

Critical-area planting helps to stabilize areas of highly erodible soils where vegetation is difficult to establish. It is most practical on soils where the flow of runoff is concentrated and the slope is more than about 6 percent.

Soil blowing is a hazard on soils that have a surface layer of loamy sand, sandy loam, fine sandy loam, or muck. Most areas of these soils, however, currently have a protective cover of vegetation. Soil blowing can damage the soils in a short time if winds are strong and the soils are dry and bare of vegetation. Field borders, field windbreaks, and vegetative wind barriers help to prevent the damage caused by soil blowing. They also conserve moisture. Conservation tillage, cover crops, green manure crops, crop residue management, grasses and legumes in the cropping sequence, regular additions of manure, and tillage methods that keep the surface rough also help to control soil blowing and conserve the water available for plant growth.

Information about the design of measures that control water erosion and soil blowing on each kind of soil is provided in the Technical Guide, which is available at the local office of the Natural Resources Conservation Service.

Soil drainage is a major management concern on much of the acreage used for crops and pasture. Most of the wetter areas are not farmed.

The poorly drained and very poorly drained soils generally are not farmed because of excessive wetness and frequent frost. Capitola, Dawson, Fordum, and Minocqua soils are examples. Most of these soils cannot be economically drained because suitable drainage outlets are not available.

The somewhat poorly drained soils are mostly used for nonfarm purposes, primarily woodland. However, small acreages of Comstock, Hatley, Moodig, Pesabic, Worcester, and Worwood soils and large acreages of Magnor and Ossmer soils are farmed. The wetness of these soils limits crop yields and the kinds of crops that can be grown. A drainage system can remove excess water.

Small areas of wetter soils are included with the moderately well drained soils in mapping. A drainage system is needed in some of these included areas to promote uniform drying.

Surface drainage systems provide for the orderly removal of the excess surface water resulting from spring runoff or heavy rains. The systems may consist of diversions, grassed waterways, field ditches, land smoothing, land grading, or a combination of these. On Comstock and Ossmer soils and in nearly level areas of Hatley and Magnor soils, a surface drainage system can improve the growing conditions for most crops. The sides of ditches in areas of the Comstock and Ossmer soils should be flattened because the substratum of these soils is unstable. In many areas diversions are needed on the adjoining uplands to protect the soils from upland runoff. The runoff or seepage from the uplands also can be intercepted by field ditches at the base of the upland slopes. Land smoothing helps to prevent the crop damage caused by ponding in nearly level areas of Antigo, Crystal Lake, and Sconsin soils.

Subsurface drainage systems remove free water from below the surface. The drains lower the water table and thus improve growing conditions for most crops. Generally, subsurface tile drains carry the water to specific drainage outlets. Ditches also can be used to lower the water table, especially in soils that have good permeability. The ditches can serve as suitable outlets for tile drains in areas where a natural outlet is not available. The sides of the ditches in the areas of

Comstock, Ossmer, Worcester, and Worwood soils should be flattened because they may be unstable. The tile drains should be continuous tubing and should be protected by filters, which keep fine particles of silt and sand from clogging the drains. Frost action in the soils can cause displacement of the tile drains. This displacement can be prevented by using continuous tubing or by installing the tile drains below the depth of freezing. Interceptor tile drains can reduce the wetness in the soils by intercepting seepage from the adjoining uplands. Tile drains are not practical in some areas of Magnor soils, especially the nearly level areas, because water moves too slowly through the soil profile.

Information about the design of drainage systems for each kind of soil is provided in the Technical Guide, which is available at local offices of the Natural Resources Conservation Service.

Soil fertility is naturally low in the sandy Au Gres, Augwood, Croswell, Croswood, Sayner, and Vilas soils. Some of the most fertile soils in the county are the very deep, silty soils, such as Comstock, Crystal Lake, Freeon, Goodman, Goodwit, Hatley, and Magnor soils, which have a high available water capacity.

Fertility can be improved by applying nutrients. The response to additions of plant nutrients is limited on most of the soils, however, because of acid soil conditions, wetness, low available water content during dry periods, or a combination of these soil properties. Most of the soils have a low supply of potassium. Applications of nitrogen, phosphorus, and potassium generally are needed. Applications of boron generally are needed to help in establishing a good stand of legumes on dairy farms. Applications of sulfur are beneficial on the sandy soils.

Fertility also can be improved or maintained by using measures that add organic matter to the soil. Examples are applying barnyard manure, plowing a green manure crop under, and returning crop residue to the soil.

All of the cropped soils in the county are naturally acid. Applications of lime are needed to raise the pH level sufficiently for good growth of alfalfa and other crops that grow best on nearly neutral soils.

On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor in the germination of seeds, the emergence of seedlings, and the infiltration of water into the soil. Soils that have good tilth are granular and porous. Tilth generally is good in the soils in Lincoln County if the surface layer has a high or very high content of organic matter or is loamy sand, sandy loam, fine sandy loam, or loam.

Most of the cropped soils in the county have a surface layer of silt loam that has a moderate or moderately low content of organic matter. Intensive rainfall on these soils results in puddling and crusting of the surface layer. The formation of crusts is especially common in eroded areas where organic matter in the surface layer has been lost through erosion. The crust, which is hard when dry, reduces the rate of water infiltration. In most areas crusting increases the runoff rate. On nearly level soils in swales and furrows, it increases the extent of ponding. The crust also restricts the emergence of seedlings. Cover crops, green manure crops, crop residue management, grasses and legumes in the cropping sequence, regular additions of manure, and mulching improve soil structure and help to prevent crusting.

Excessive tillage, use of heavy farm machinery, overgrazing, and tilling or grazing when the soil is too wet can result in surface compaction and thus in poor tilth. Excessive tillage can be avoided if a system of conservation tillage is applied. Proper stocking rates and rotation grazing can prevent overgrazing. Chisel plowing helps to loosen compacted soil.

Surface stones are common in some areas of Freeon, Goodman, Goodwit, Hatley, Keweenaw, Magnor, Magroc, Mequithy, Moodig, Newood, Newot, Pesabic, Sarona, and Sarwet soils, which formed wholly or partly in glacial till. These areas cannot be tilled unless the stones are removed.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 8. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered (Klingelhoets and Beatty, 1966).

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure,

and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 8 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (USDA, 1961). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs

Figure 26.—Tahoe Lake in an area of the Sarona-Keweenaw-Goodman association. Lincoln County has many scenic lakes that provide opportunities for outdoor recreation.

can be obtained from local offices of the Natural Resources Conservation Service, the Wisconsin Department of Natural Resources, or the Cooperative Extension Service or from a commercial nursery.

Recreation

Lincoln County provides many opportunities for outdoor recreation. The major attractions for outdoor enthusiasts are the many species of fish and wildlife, the scenic wooded landscape, the large remote areas that retain a wilderness quality, and the many lakes and streams (fig. 26). Recreational facilities are needed to accommodate the local population and the seasonal influx of tourists and vacationers.

Public ownership of recreational resources helps to prevent development for other uses and ensures access. About 25 percent of the woodland in the county is publicly owned. Entire shorelines of many small lakes also are publicly owned. Public access is provided on most of the lakes. About 22 percent of the lake frontage and 16 percent of the stream frontage is publicly owned. State ownership of frontage along spring ponds and prime trout streams, such as the Prairie River, is increasing.

Fish and other wildlife resources are ample and

Figure 27.—A woodland trail in an area of a Keweenaw sandy loam.

readily available for fishing, hunting, trapping, and viewing. Preservation of wildlife habitat is vitally important if the county is to continue providing recreational opportunities. New Wood Wildlife Area,

Spring Lake Fishery Area, Merrill Memorial Forest, Rib River Area, and Prairie River Fishery Area are intensively managed for the production of wildlife. Public forests are managed for increasing wildlife populations. Many trails are managed as grouse hunting trails.

Woodland resources are used for recreational activities, such as snowmobiling, hunting, cross-country skiing, all-terrain vehicle riding, hiking, picnicking, snowshoeing, biking, and horseback riding. Many paths and trails, including old logging and tote roads, meander through the forests (fig. 27). Hiking is available on many trails, including the scenic Ice Age Trail. The Rails to Trails biking trail was recently established on an abandoned railroad grade. The county has a large network of snowmobile and all-terrain vehicle trails. Three major cross-country skiing trails are available (fig. 28). Woodland provides the setting for several golf courses and downhill ski areas.

Water resources are used for fishing, boating, canoeing, rafting, sailing, waterskiing, swimming, trapping, and waterfowl hunting. They also are used for skating and snowmobiling in winter. Some lakes and impoundments, including Alexander, Alice, Bridge, Clear, Grandfather, Harrison, Jersey City, Mohawksin, and Somo Lakes and the Spirit River Flowage, are suitable for fast boating, sailing, and waterskiing.

Lincoln County has many miles of water frontage along lakes and streams. Some of this frontage, mostly along the larger water areas, is developed and used for resorts, organizational camps, campgrounds, cottages, summer homes, and year-round homes. Access to lakes or streams is provided on all of the campgrounds in the county. The Council Grounds State Park, Camp New Wood and Otter Lake county parks, and some of the local parks are on water frontage where recreational facilities, such as swimming areas, bathhouses, and boat ramps, are available. The parks and some of the waysides include playgrounds, picnic areas, ball diamonds, horseshoe courts, grills, and hiking trails.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are nearly level or gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Steeper slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject

Figure 28.—A cross-country ski trail in an area of a Padus sandy loam.

to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Robert D. Weihrouch, biologist, Natural Resources Conservation Service, helped prepare this section.

Lincoln County has numerous wildlife species because of the diversity provided by wetland, woodland, cropland, areas of open water, and remote areas. The rare mammals in the remote wild areas include timber wolf, fisher, and bobcat. The common mammals are whitetail deer, black bear, coyote, red fox, porcupine, beaver, snowshoe hare, otter, raccoon, skunk, gray squirrel, muskrat, mink, cottontail, and many small animals.

Ruffed grouse and woodcock are the common woodland game birds. Crows, ravens, hawks, owls, woodpeckers, and a variety of songbirds also inhabit the woodland. Redwing blackbirds, sparrows, bobolinks, and meadowlarks are common in the areas of cropland. The surface water areas attract a variety of birds,

including wood duck, teal, mallard, geese, herons, shore birds, loons, bald eagles, and ospreys.

The many lakes, impoundments, and streams support many species of fish, including muskellunge, trout, northern pike, walleye, largemouth bass, smallmouth bass, and panfish, such as perch, sunfish, bluegill, crappie, and pumpkinseed.

Areas of the poorly drained or very poorly drained Capitola, Cathro, Dawson, Fordum, Loxley, Lupton, Markey, and Minocqua soils provide good wetland habitat for wildlife. These areas occur as brushy wetland, freshwater marshes, meadows, or wooded swamps, which provide the habitat diversity needed by many species of wildlife.

Wildlife habitat on many of the soils in Lincoln County can be enhanced by increasing the supply of food and water and the amount of cover. Woodland trails can be planted to white clover. Large stands of upland hardwoods can be enhanced as wildlife habitat by using logging methods that create brushy areas and by planting clumps of conifers near trails and clearings. Creating impoundments in drainageways improves habitat for waterfowl and furbearers. Constructing dugout ponds and level ditches in areas of wet soil also provides areas of open water. The habitat also can be improved by management that preserves den trees, favors production of herbaceous vegetation and shrubs, provides seedlings and saplings for browse, and favors oak trees for the production of mast. Protection from fire helps to preserve the woodland part of the habitat.

The paragraphs that follow specify the kinds of habitat and wildlife species characteristic of the soil associations in the survey area, which are described under the heading "General Soil Map Units." Each association has a distinctive pattern of soils, relief, and drainage that generally affects the wildlife inhabiting the association. The habitat components are further described under the headings "Woodland Management and Productivity" and "Forest Habitat Types." The plant species common on specific soils are described for each soil under the heading "Detailed Soil Map Units."

The *Magnor-Freeon-Capitola association* is an area of mostly nearly level to sloping upland dissected by long drainageways that broaden into basins in places. The drainageways and basins include many wetland areas, such as wooded swamps, brush swamps, freshwater marshes, and wet meadows. Open wetlands are scarce, but there are some dugout ponds. This area has diverse wildlife habitat because of the intermixture of cropland, pasture, upland woods, and wetlands. The habitat is enhanced by small areas of idle cropland and conifer tree plantations. Generally, the silty upland soils support a lush growth of plants for wildlife habitat. The upland woods are mostly hardwoods, but some conifers are in low areas. Some of the best habitat for whitetail deer, ruffed grouse, and other wildlife is in areas where tree cutting has fostered young stands of aspen and hardwoods. The major crops in the farmed areas are oats, red clover, alfalfa, forage grasses, and corn. Many of the fence rows provide good cover for wildlife. This association attracts most of the common woodland and openland wildlife species.

The *Ossmer-Minocqua-Sconsin association* is generally an area of flat plains in major river valleys. The flats are interspersed with many depressional areas. The diversity and kinds of habitat elements are similar to those in the Magnor-Freeon-Capitola association, except this area has more wetland, especially areas of open water. It also has a larger acreage of idle cropland and some stands of eastern white pine on droughty sites. This association has many streams and rivers and a few impoundments, dugout ponds, beaver ponds, sloughs, and oxbows that provide excellent habitat for waterfowl, furbearers, and the rare wood turtle. Most of the common wildlife species in the county are attracted to the diverse habitat in this association.

The *Magnor-Lupton-Capitola association* is mostly an area of nearly level and gently sloping upland woods interspersed with many wetlands. Open wetlands are scarce, but there are small streams and beaver ponds in drainage valleys. The association includes large areas of county forest. It provides large remote areas of wild land for rare wildlife species, such as fisher, bobcat, and timber wolf. Generally, the silty upland soils support a lush growth of plants for wildlife habitat. The upland woods are mostly even-aged stands of aspen and hardwoods because of repeated harvests of young timber. The areas of mature forest are mostly hardwoods, but aspen and balsam fir are in low areas. Wooded and shrub swamps are along upland drainageways. Small areas of freshwater marshes and meadows are along the streams. Large areas of bog and conifer swamps are in broad drainage valleys. The bog vegetation is mainly wetland plants, such as mosses and leatherleaf, and a few stunted spruce and tamarack trees. The conifer swamps are cedar, spruce, balsam fir, and tamarack. This association provides good habitat for the common woodland wildlife species in the county.

The *Sarona-Keweenaw-Goodman association* includes large areas of county forest. The area is mostly rolling to very steep upland woods, but small pockets of wetland habitat occur throughout the landscape as lakes, ponds, bogs, and conifer swamps. This morainic area has a rough terrain and few good motor roads, except in an area near Irma, but old logging roads meander throughout the remote areas.

The wildlife habitat is more diverse near Irma because some acreage is farmed. The woodland habitat is mainly hardwoods with scattered small stands of hemlock, but young stands of aspen and birch occur throughout the area. The timber stands contain pine and oak in areas where the Keweenaw soils are dominant, such as the Harrison Hills. The typical wildlife species include whitetail deer, black bear, fisher, squirrels, coyote, porcupine, and ruffed grouse and other woodland birds.

The *Newood-Magnor-Freeon association* includes large areas of commercial forest. The wildlife habitat is mostly nearly level to rolling upland woods, primarily northern hardwoods and some hemlock, intermingled with small areas of wetland, such as bogs, wooded swamps, and brushy areas. The wooded swamps are mostly conifers and partly hardwoods. The association supports scattered stands of northern red oak, which provide important mast for many wildlife species. In many areas, logging has fostered young, mixed stands of aspen, balsam fir, and hardwoods. Generally, this morainic area has a rough landscape, but there are some areas of smooth terrain. The association has few good motor roads, but old logging roads meander throughout the remote areas, which provide secluded habitat for fisher, bobcat, black bear, and timber wolf. Open wetlands are scarce, but there are some small streams and beaver ponds. East of the Wisconsin River, the wildlife habitat is more diverse because some acreage is farmed. This association provides excellent habitat for the common woodland wildlife species in the county.

The *Sarwet-Moodig-Lupton association* is mostly an area of nearly level and gently sloping upland woods intermingled with bogs and conifer swamps in drainage valleys, but there are small areas where cropland and pasture add habitat diversity. Open wetlands are scarce, but there are small streams and beaver ponds in the valleys. A few small areas of meadow and freshwater marshes occur along the streams. The wooded upland habitat is mostly maple and partly hemlock, but balsam fir and aspen are on the lower foot slopes. Young stands of aspen, balsam fir, and hardwoods occur throughout the woodland. The association provides a good mixture of woodland habitat for wildlife species, such as whitetail deer, black bear, fisher, coyote, snowshoe hare, timber wolf, ruffed grouse, and woodcock.

The *Vilas-Croswell-Markey association* is generally a flat, sandy upland area of native woods, pine plantations, and idle cropland interspersed with conifer swamps, bogs, and brushy wetland in depressions. Surface-water habitat is abundant, including rivers, streams, large impoundments, and many lakes that attract waterfowl, furbearers, loons, eagles, and osprey. This association also provides important habitat for the rare wood turtle. Most of the water frontage is developed as sites for homes and cottages, and many rural homesites affect the dispersion of wildlife. Numerous birds and other wildlife are attracted to the diverse habitat. The native woods of pine, northern red oak, white birch, red maple, aspen, and balsam fir provide essential food and cover for wildlife, including squirrels, whitetail deer, and ruffed grouse. Black bear, coyote, and fisher inhabit the western part of the area.

The *Lupton-Padwet-Minocqua association* is mostly an area of drainage valleys and basins where conifer swamps, brushy wetlands, marshes, and wet meadows are intermixed with small areas of nearly level and gently sloping upland woods. The habitat provides good refuge for whitetail deer, black bear, fisher, ruffed grouse, and coyote. Some areas of cropland help to diversify the habitat. The upland woods are sugar maple and hemlock or aspen, balsam fir, and hardwoods. The area includes a flowage, a few lakes, and many streams, oxbows, and sloughs that provide important habitat for waterfowl, furbearers, eagles, osprey, and the rare wood turtle.

The *Pence-Padus-Antigo association* is mostly an area of nearly level to very steep upland wildlife habitat where woodland, cropland, and pasture are mixed in the landscape, but a few areas of wetland add to the diversity. The upland woods are generally sugar maple interspersed with young stands of aspen and hardwoods, but there are small stands of hemlock and pine. The area provides good habitat for wildlife species that favor woodland or the combination of woodland and farmland.

The *Vilas-Sayner-Keweenaw association* is mostly an area of rolling to very steep woodland dominated by pine, northern red oak, paper birch, and red maple. The oak is an important source of mast for many species of wildlife. Balsam fir and aspen are in young timber stands. Wetland habitat is scarce, but there are a few lakes and streams. The mixed habitat of hardwoods and conifers in this area attracts many kinds of wildlife, such as whitetail deer, black bear, fisher, squirrels, and a variety of birds, including ruffed grouse.

The *Croswood-Lupton-Augwood association* is mostly an area of wetland wildlife habitat and nearly level and gently sloping, sandy upland woods. The wetlands are in long drainage valleys and include swamps, wet meadows, and brushy areas. Some pine plantations are in the uplands. Open wetlands are scarce, but there are a few streams in the valleys. The upland areas support primarily pine, northern red oak, paper birch, red maple, aspen, and balsam fir. Mast produced by the oak is an important wildlife habitat element. The area provides

good habitat for whitetail deer, black bear, fisher, coyote, timber wolf, squirrels, porcupines, snowshoe hare, and many kinds of birds, including ruffed grouse, crows, ravens, hawks, and owls.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley (fig. 29).

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are lambsquarters, goldenrod, ragweed, foxtail, and bluegrass.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, maple, cherry, hazelnut, apple, aspen, dogwood, birch, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are highbush cranberry, gray dogwood, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and hemlock.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wild rice, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobolink, killdeer, meadowlark, song sparrow, cottontail, and red fox.

Figure 29.—An unharvested patch of corn in an area of a Magnor silt loam provides grain for deer during the harsh winter months.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants (fig. 30). Wildlife attracted to these areas include snowshoe hare, ruffed grouse, woodcock, bobcat, woodpeckers, squirrels, coyote, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas (fig. 31). Some of the wildlife attracted to such areas are ducks, geese, herons, otters, muskrat, mink, and beaver.

Engineering

Duane F. Wallace, agricultural engineer, Natural Resources Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills,

Figure 30.—Hardwood trees, woody understory, and associated grasses, legumes, and wild herbaceous plants in an area of Magnor soils. This combination of vegetation provides good habitat for woodland wildlife, such as ruffed grouse.

Figure 31.—Muskrat houses in a marshy area along the Wisconsin River. The trees in the background are in an area of a Freeon silt loam.

septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to

overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential (fig. 32), and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the

Figure 32.—Road damage resulting from frost action in an area of Magnor soils.

solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications

for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and bedrock.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding;

slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity in the root zone. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Duane F. Wallace, agricultural engineer, Natural Resources Conservation Service, helped prepare this section.

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

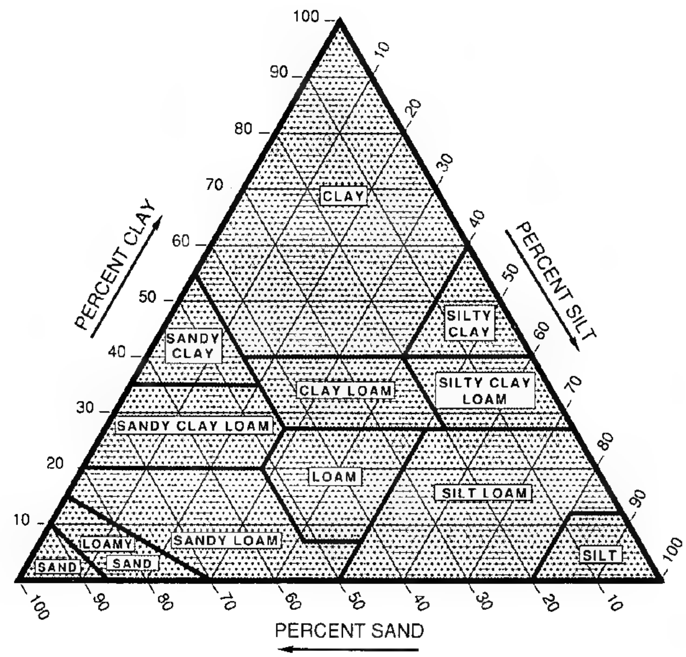

Figure 33.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 33). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution

of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments larger than 10 inches and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution are rounded to the nearest 5 percent. Thus, if the ranges of gradation extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available

water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are

assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 18 shows the expected total subsidence, which is usually a result of drainage and oxidation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing.

Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Wisconsin Department of Transportation, Division of Highways and Transportation Facilities.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); and Plasticity index—T 90 (AASHTO), D 4318 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Inceptisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquept (*Aqu*, meaning water, plus *ept*, from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Endoaquepts (*Endo*, meaning apparent water table, plus *aquept*, the suborder of the Inceptisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Endoaquepts.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, frigid Typic Endoaquepts.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Antigo Series

The Antigo series consists of well drained soils that formed in silty and loamy deposits and in the underlying sand and gravel. These soils are on outwash plains, in

glacial lake basins, and in outwash areas on morainic landscapes. Permeability is moderate in the upper part of the profile and rapid or very rapid in the lower part. Slope ranges from 1 to 15 percent.

Typical pedon of Antigo silt loam, 1 to 6 percent slopes, approximately 1,190 feet east and 2,500 feet north of the southwest corner of sec. 28, T. 31 N., R. 7 E.

A—0 to 4 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; about 2 percent gravel; moderately acid; abrupt wavy boundary.

Bs—4 to 9 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; very friable; many fine roots; common very dark gray (10YR 3/1) wormcasts; about 2 percent gravel; strongly acid; clear wavy boundary.

E/B—9 to 17 inches; about 80 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; friable; extends into or surrounds remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; friable; few distinct dark brown (7.5YR 3/4) clay films on faces of peds; common fine roots; few distinct very dark gray (10YR 3/1) wormcasts; about 2 percent gravel; moderately acid; clear wavy boundary.

B/E—17 to 21 inches; about 70 percent dark yellowish brown (10YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; friable; common prominent dark reddish brown (5YR 3/4) clay films on faces of peds; penetrated by brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; friable; common fine roots; about 2 percent gravel; very strongly acid; clear wavy boundary.

2Bt1—21 to 27 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable; common fine roots; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds; many distinct brown (10YR 5/3) coatings of silt and sand primarily on vertical faces of peds; about 8 percent gravel and 1 percent cobbles; very strongly acid; clear wavy boundary.

2Bt2—27 to 31 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak fine subangular blocky structure; friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds; about 20 percent gravel and 2 percent cobbles; very strongly acid; clear wavy boundary.

3C—31 to 60 inches; strata of brown (7.5YR 5/4) very gravelly sand and sand; single grain; loose; an average of about 25 percent gravel and 2 percent cobbles; strongly acid.

The thickness of the solum ranges from 22 to 40 inches. The silty mantle ranges from 12 to 30 inches in thickness. The content of gravel ranges from 0 to 5 percent in the silty mantle, from 0 to 35 percent in the 2Bt horizon, and from 0 to 60 percent in the 3Bt horizon, if it occurs, and in the 3C horizon. The content of cobbles ranges from 0 to 2 percent in the silty mantle and from 0 to 5 percent in the 2Bt and 3C horizons and in the 3Bt horizon, if it occurs.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 2 to 5 inches thick. The 2Bt horizon is loam or sandy loam or the gravelly or very gravelly analogs of those textures. The 3Bt horizon, if it occurs, is sand, coarse sand, loamy sand, loamy coarse sand, or the gravelly or very gravelly analogs of those textures. The strata in the 3C horizon are sand, coarse sand, or the gravelly or very gravelly analogs of those textures.

Au Gres Series

The Au Gres series consists of somewhat poorly drained, rapidly permeable soils that formed in sandy deposits. These soils are on outwash plains and in outwash areas on morainic and drumlin landscapes. Slope ranges from 0 to 3 percent.

Typical pedon of Au Gres loamy sand, 0 to 3 percent slopes, approximately 2,180 feet west and 2,550 feet south of the northeast corner of sec. 33, T. 35 N., R. 5 E.

A—0 to 2 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; moderate fine and medium granular structure; friable; many fine roots; many uncoated sand grains; very strongly acid; abrupt wavy boundary.

E—2 to 5 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) sand, light brownish gray (10YR 6/2) dry; weak very fine subangular blocky structure; very friable; many fine roots; very strongly acid; abrupt wavy boundary.

Bhs—5 to 8 inches; dark reddish brown (5YR 3/3) loamy sand; common fine distinct yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; very friable; many fine roots; very strongly acid; abrupt broken boundary.

Bs1—8 to 13 inches; dark brown (7.5YR 3/4) sand; few fine prominent dark red (2.5YR 3/6) and common medium prominent yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; very friable; many fine roots; strongly acid; clear wavy boundary.

Bs2—13 to 21 inches; dark brown (7.5YR 4/4) sand; many fine prominent dark red (2.5YR 3/6) and many coarse prominent yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; very friable; common fine roots; strongly acid; clear wavy boundary.

BC—21 to 32 inches; brown (10YR 5/3) sand; few coarse distinct brown (7.5YR 5/4) and many coarse prominent dark red (2.5YR 3/6) mottles; single grain; loose; few fine roots; common prominent very dusky red (2.5YR 2/2) and dark reddish brown (2.5YR 2/4) concretions of iron and manganese oxide; strongly acid; gradual wavy boundary.

C—32 to 60 inches; brown (10YR 5/3) sand; few coarse prominent strong brown (7.5YR 5/8) mottles; single grain; loose; about 2 percent gravel; moderately acid.

The thickness of the solum ranges from 20 to 48 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E, Bhs, and Bs horizons are sand or loamy sand.

Augwood Series

The Augwood series consists of somewhat poorly drained soils in outwash-veneered areas of moraines and drumlins. These soils formed in sandy deposits underlain by loamy glacial till. Permeability is rapid in the upper part of the profile and moderate in the lower part. Slope ranges from 0 to 3 percent.

Typical pedon of Augwood loamy sand, 0 to 3 percent slopes, approximately 110 feet south and 1,520 feet east of the northwest corner of sec. 2, T. 35 N., R. 5 E.

A—0 to 1 inch; very dark gray (10YR 3/1) loamy sand, dark gray (10YR 4/1) dry; moderate medium granular structure; very friable; many fine roots; about 4 percent gravel and 1 percent cobbles; many uncoated sand grains; extremely acid; abrupt wavy boundary.

E—1 to 3 inches; grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry; weak fine subangular blocky structure; very friable; many fine roots; less than 1 percent gravel and about 1 percent cobbles; extremely acid; abrupt broken boundary.

Bhs—3 to 6 inches; dark reddish brown (5YR 3/3) loamy sand; common fine distinct yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; very friable; many fine roots; about 1 percent cobbles; very strongly acid; clear broken boundary.

Bs1—6 to 11 inches; dark brown (7.5YR 3/4) sand; few fine prominent dark red (2.5YR 3/6) and common fine prominent yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; very friable; many fine roots; about 1 percent gravel and 1 percent cobbles; very strongly acid; abrupt wavy boundary.

Bs2—11 to 21 inches; dark brown (7.5YR 4/4) sand; common medium prominent yellowish red (5YR 5/6) and many fine prominent dark red (2.5YR 3/6) mottles; weak medium subangular blocky structure; very friable; common fine roots; about 1 percent gravel and 2 percent cobbles; very strongly acid; clear wavy boundary.

Bw—21 to 36 inches; strong brown (7.5YR 5/6) sand; common medium prominent yellowish red (5YR 5/8), common coarse distinct brown (7.5YR 5/3), and many coarse prominent dark red (2.5YR 3/6) mottles; common coarse prominent grayish brown (10YR 5/2) mottles occurring as vertical streaks; weak coarse subangular blocky structure; very friable; few fine roots primarily in the grayish brown vertical streaks; few weakly cemented chunks of dark red (2.5YR 3/6) ortstein as much as 3 inches in diameter; less than 1 percent gravel and about 1 percent cobbles; moderately acid; gradual wavy boundary.

C1—36 to 55 inches; brown (7.5YR 5/3) sand; few medium distinct strong brown (7.5YR 5/6) mottles; single grain; loose; few fine roots; about 1 percent gravel and 2 percent cobbles; strongly acid; abrupt wavy boundary.

2C2—55 to 80 inches; brown (10YR 4/3) gravelly loamy sand; few fine faint grayish brown (10YR 5/2) and few fine prominent strong brown (7.5YR 4/6) mottles in the upper 2 inches; massive; friable; few fine roots; about 20 percent gravel and 4 percent cobbles; moderately acid.

The thickness of the solum ranges from 20 to 40 inches. Depth to the 2C horizon ranges from 40 to 60 inches. The content of gravel ranges from 0 to 15 percent in the sandy outwash and from 5 to 30 percent in the till. The content of cobbles ranges from 0 to 5 percent in the solum and the C horizon and from 0 to 10 percent in the 2C horizon.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E, Bhs, and Bs horizons are sand or loamy sand. The 2C horizon is sandy loam or gravelly sandy loam.

Capitola Series

The Capitola series consists of very poorly drained soils that formed in silty or loamy deposits and in the

underlying loamy glacial till. These soils are on moraines and drumlins. Permeability is moderate or moderately slow in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Capitola muck, in an area of Minocqua and Capitola mucks, 0 to 2 percent slopes, approximately 1,840 feet north and 70 feet west of the southeast corner of sec. 12, T. 33 N., R. 8 E.

Oa—0 to 5 inches; muck, black (10YR 2/1) broken face and rubbed, very dark gray (10YR 3/1) pressed; about 30 percent fiber, 9 percent rubbed; moderate very fine subangular blocky structure; very friable; many fine roots; primarily herbaceous fibers and some woody ones; about 20 percent mineral ash material; brown (10YR 4/3) sodium pyrophosphate extract; about 5 percent dark brown (7.5YR 4/4) wood fragments; strongly acid (pH 5.3 by Truog method); abrupt smooth boundary.

A—5 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; few fine prominent dark brown (7.5YR 3/4) mottles; weak fine subangular blocky structure; friable; many fine roots; about 1 percent gravel and 10 percent cobbles; strongly acid; abrupt wavy boundary.

Bg1—7 to 10 inches; gray (10YR 5/1) silt loam; common fine prominent dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm; a few vertical cleavage planes; few fine roots; about 1 percent gravel; moderately acid; abrupt wavy boundary.

Bg2—10 to 15 inches; dark grayish brown (10YR 4/2) silt loam; common fine prominent dark brown (7.5YR 4/4) and common medium faint gray (10YR 5/1) and brown (10YR 5/3) mottles; weak medium subangular blocky structure; firm; a few vertical cleavage planes; few fine roots; common fine prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; about 1 percent gravel; very strongly acid; clear wavy boundary.

Bg3—15 to 22 inches; grayish brown (10YR 5/2) silt loam; few fine prominent dark red (2.5YR 3/6), common medium faint brown (10YR 5/3), and many medium prominent yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; friable; a few vertical cleavage planes; few fine roots; common fine prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; about 2 percent gravel; moderately acid; abrupt wavy boundary.

2Btg—22 to 33 inches; brown (7.5YR 4/2) sandy loam; few fine prominent greenish gray (5GY 5/1), common medium faint brown (7.5YR 5/2), common medium distinct dark brown (7.5YR 4/4), and many fine prominent reddish brown (5YR 4/4) mottles; moderate thin and very thin platy structure; friable; a few vertical cleavage planes; few fine roots; common distinct very dark gray (10YR 3/1) clay films on faces of peds and many in pores; common fine and medium prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; about 8 percent gravel and 2 percent cobbles; strongly acid; gradual wavy boundary.

2C—33 to 60 inches; dark brown (7.5YR 4/4) sandy loam; few fine prominent yellowish red (5YR 4/6) mottles; massive; friable; about 8 percent gravel and 2 percent cobbles; moderately acid.

The thickness of the solum ranges from 20 to 40 inches. The silty mantle ranges from 0 to 30 inches in thickness. The content of gravel ranges from 0 to 15 percent in the silty or loamy mantle and from 5 to 25 percent in the till. The content of cobbles ranges from 0 to 15 percent throughout the profile.

The Oa horizon has hue of 5YR, 7.5YR, or 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3 and chroma of 0. It is 2 to 6 inches thick. The A and Bg horizons are sandy loam, fine sandy loam, loam, or silt loam. The 2Btg and 2C horizons commonly are fine sandy loam, gravelly fine sandy loam, sandy loam, or gravelly sandy loam, but in some pedons they are loamy sand or gravelly loamy sand.

Cathro Series

The Cathro series consists of very poorly drained soils that formed in organic material over silty or loamy deposits. These soils are on outwash plains, in glacial lake basins, and on moraines. Permeability is moderately rapid to moderately slow in the organic material and moderate or moderately slow in the mineral deposits. Slope is 0 to 1 percent.

Typical pedon of Cathro muck, in an area of Lupton, Cathro, and Markey mucks, 0 to 1 percent slopes, approximately 1,030 feet west and 2,530 feet south of the northeast corner of sec. 35, T. 34 N., R. 7 E.

Oa1—0 to 15 inches; muck, black (5YR 2/1) broken face, dark reddish brown (5YR 2/2) rubbed and pressed; about 15 percent fiber, 3 percent rubbed; weak fine subangular blocky structure; very friable; many fine roots; herbaceous and woody fibers; dark brown (10YR 4/3) sodium pyrophosphate extract; about 10 percent dark reddish brown (5YR 3/3) wood fragments; moderately acid (pH 5.7 by Truog method); clear smooth boundary.

Oa2—15 to 28 inches; muck, dark reddish brown (5YR

3/2) broken face, dark reddish brown (5YR 2/2) rubbed and pressed; about 30 percent fiber, 5 percent rubbed; massive; very friable; woody and herbaceous fibers; dark brown (10YR 4/3) sodium pyrophosphate extract; about 2 percent dark reddish brown (5YR 3/3) wood fragments; moderately acid (pH 5.8 by Truog method); abrupt smooth boundary.

Cg1—28 to 49 inches; dark gray (5Y 4/1) loam; common medium prominent olive brown (2.5Y 4/4) mottles; massive; friable; about 3 percent gravel; slightly acid; clear wavy boundary.

Cg2—49 to 60 inches; dark grayish brown (2.5Y 4/2) sandy loam; common medium distinct olive brown (2.5Y 4/4) mottles; massive; friable; about 5 percent gravel and 1 percent cobbles; moderately acid.

The organic material is 16 to 51 inches thick. Many pedons have a surface cover of sphagnum moss as much as 4 inches thick. The content of wood fragments in the organic material ranges from 0 to 15 percent.

The muck has hue of 5YR, 7.5YR, or 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3 and chroma of 0. Some pedons have a few thin layers of mucky peat within the muck. The Cg horizon is silt loam, loam, sandy loam, or gravelly sandy loam or is dominantly silty clay loam, silt loam, silt, loam, fine sandy loam, or very fine sandy loam that has thin strata of fine sand, very fine sand, loamy fine sand, or loamy very fine sand. The content of gravel in this horizon ranges from 0 to 25 percent.

Comstock Series

The Comstock series consists of somewhat poorly drained soils that formed in dominantly silty lacustrine deposits. These soils are in glacial lake basins. Permeability is moderate in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 3 percent.

Typical pedon of Comstock silt loam, 0 to 3 percent slopes, approximately 600 feet west and 2,310 feet north of the southeast corner of sec. 21, R. 34 N., R. 8 E.

A—0 to 2 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; many fine roots; moderately acid; abrupt wavy boundary.

E1—2 to 6 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak medium platy structure; friable; many fine roots; many faint black (10YR 2/1) wormcasts; moderately acid; clear wavy boundary.

E2—6 to 11 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/2) dry; few fine prominent yellowish red (5YR 4/6) and common fine prominent strong brown (7.5YR 5/6) mottles; weak medium platy structure; friable; many fine roots; few fine prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; moderately acid; clear wavy boundary.

E/B—11 to 16 inches; about 70 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate thin platy structure; friable; extends into or surrounds remnants of reddish brown (5YR 4/4) silt loam (Bt); few fine prominent strong brown (7.5YR 5/6) and many fine distinct yellowish red (5YR 4/6) mottles; moderate very fine angular blocky structure; friable; tends to part along horizontal cleavage planes inherited from the parent material; common distinct dark reddish brown (2.5YR 3/4) clay films on faces of peds; common fine roots; common fine distinct dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; moderately acid; clear wavy boundary.

B/E—16 to 22 inches; about 60 percent reddish brown (2.5YR 4/4) silty clay loam (Bt); few fine distinct dark red (2.5YR 3/6), few fine prominent light gray (5Y 6/1), common medium prominent grayish brown (2.5Y 5/2), and many fine prominent yellowish red (5YR 4/6) mottles; moderate fine angular blocky structure; firm; tends to part along horizontal cleavage planes inherited from the parent material; common faint dark reddish brown (2.5YR 3/4) clay films on faces of peds; penetrated by brown (7.5YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; friable; common fine roots; many fine prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt1—22 to 36 inches; reddish brown (2.5YR 4/4) silty clay loam; few fine distinct dark red (2.5YR 3/6), few fine prominent light gray (5Y 6/1), common fine distinct red (2.5YR 4/6), and common fine prominent light brownish gray (2.5Y 6/2) mottles; moderate medium and coarse prismatic structure parting to moderate medium and coarse angular blocky; firm; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; many faint dark reddish brown (2.5YR 3/4) clay films on faces of peds and many distinct reddish brown (5YR 4/3) clay films on faces of prisms and in pores; few fine and medium prominent black (5YR 2/1) concretions of iron and manganese oxide; moderately acid; gradual irregular boundary.

Bt2—36 to 57 inches; reddish brown (5YR 5/3) silt loam that has a few thin strata of reddish brown (2.5YR 4/4) silty clay loam and red (2.5YR 4/6) fine sand;

few fine prominent gray (5Y 5/1), common fine faint dark reddish brown (5YR 3/4), common fine distinct yellowish red (5YR 4/6), and common fine prominent light brownish gray (2.5Y 6/2) mottles; weak coarse prismatic structure parting to weak medium angular blocky; friable; tends to part along horizontal cleavage faces inherited from the parent material; few fine roots; common distinct dark reddish brown (2.5YR 3/4) clay films on faces of peds and many faint reddish brown (5YR 4/3) clay films on faces of prisms and in pores; few fine distinct black (5YR 2/1) concretions of iron and manganese oxide; moderately acid; gradual irregular boundary.

C—57 to 60 inches; reddish brown (5YR 5/3) silt loam that has a few thin strata of reddish brown (2.5YR 4/4) silty clay loam and red (2.5YR 4/6) fine sand; common fine distinct yellowish red (5YR 4/6), common fine prominent light brownish gray (2.5Y 6/2), and many fine distinct dark brown (7.5YR 4/4) mottles; massive; friable; tends to part along horizontal cleavage planes inherited from the parent material; moderately acid.

The thickness of the solum ranges from 30 to 60 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 2 to 5 inches thick. The Bt2 and C horizons are dominantly silt loam but have thin strata of silty clay loam, silt, loam, fine sandy loam, very fine sandy loam, fine sand, very fine sand, loamy fine sand, or loamy very fine sand.

Croswell Series

The Croswell series consists of moderately well drained, rapidly permeable soils that formed in sandy deposits. These soils are on outwash plains and in outwash areas on morainic and drumlin landscapes. Slope ranges from 1 to 6 percent.

Typical pedon of Croswell loamy sand, 1 to 6 percent slopes, approximately 2,110 feet east and 2,525 feet south of the northwest corner of sec. 33, T. 35 N., R. 5 E.

A—0 to 3 inches; very dark gray (10YR 3/1) loamy sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; many fine roots; many uncoated sand grains; strongly acid; abrupt wavy boundary.

E—3 to 5 inches; brown (7.5YR 5/2) sand, pinkish gray (7.5YR 6/2) dry; weak fine subangular blocky structure; very friable; many fine roots; moderately acid; abrupt broken boundary.

Bs1—5 to 8 inches; dark reddish brown (5YR 3/4) loamy sand; weak fine subangular blocky structure; very friable; many fine roots; tongues of Bs1 material that are 2 to 3 inches wide penetrate down to a depth of 17 inches; the overlying E horizon is thicker immediately above these tongues; strongly acid; abrupt irregular boundary.

Bs2—8 to 16 inches; dark brown (7.5YR 3/4) sand; weak medium subangular blocky structure; very friable; many fine roots; moderately acid; clear wavy boundary.

Bs3—16 to 24 inches; dark brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; very friable; common fine roots; moderately acid; gradual wavy boundary.

BC—24 to 31 inches; yellowish brown (10YR 5/4) sand; few fine prominent yellowish red (5YR 4/6) and few medium prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; very friable; few fine roots; moderately acid; gradual irregular boundary.

C1—31 to 43 inches; yellowish red (5YR 4/6) sand; common coarse prominent brown (10YR 5/3), many fine distinct dark red (2.5YR 3/6), and many medium prominent red (2.5YR 4/8) mottles; single grain; loose; few fine roots; few small weakly cemented dark red (2.5YR 3/6) masses; about 2 percent gravel; moderately acid; gradual wavy boundary.

C2—43 to 60 inches; brown (10YR 5/3) sand; common medium prominent yellowish red (5YR 4/6) and few fine prominent dark red (2.5YR 3/6) mottles; single grain; loose; few fine roots; about 1 percent gravel; moderately acid.

The thickness of the solum ranges from 20 to 45 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 4 inches thick. The E and Bs horizons are sand or loamy sand.

Croswood Series

The Croswood series consists of moderately well drained soils in outwash-veneered areas of moraines and drumlins. These soils formed in sandy deposits underlain by loamy glacial till. Permeability is rapid in the upper part of the profile and moderate in the lower part. Slope ranges from 1 to 6 percent.

Typical pedon of Croswood loamy sand, 1 to 6 percent slopes, approximately 1,070 feet east and 1,980 feet south of the northwest corner of sec. 29, T. 35 N., R. 5 E.

A—0 to 4 inches; very dark gray (10YR 3/1) loamy sand, gray (10YR 5/1) dry; moderate medium

granular structure; friable; many fine roots; common uncoated sand grains; about 2 percent gravel and 2 percent cobbles; strongly acid; abrupt smooth boundary.

E—4 to 6 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) sand, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; very friable; many fine roots; less than 1 percent gravel and about 1 percent cobbles; common faint very dark gray (10YR 3/1) wormcasts; strongly acid; abrupt broken boundary.

Bs1—6 to 9 inches; dark reddish brown (5YR 3/4) loamy sand; weak fine subangular blocky structure; very friable; many fine roots; about 1 percent gravel and 1 percent cobbles; about 10 percent weakly cemented ortstein; strongly acid; clear broken boundary.

Bs2—9 to 14 inches; dark brown (7.5YR 3/4) sand; weak medium subangular blocky structure; very friable; many fine roots; about 10 percent weakly cemented ortstein; about 1 percent gravel; strongly acid; clear wavy boundary.

Bw1—14 to 22 inches; dark brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; very friable; common fine roots; about 5 percent weakly cemented ortstein; about 1 percent gravel; strongly acid; clear wavy boundary.

Bw2—22 to 31 inches; strong brown (7.5YR 4/6) sand; common fine prominent dark reddish brown (2.5YR 3/4) and common medium distinct yellowish red (5YR 5/6) mottles; weak coarse subangular blocky structure; very friable; few fine roots; less than 1 percent gravel; strongly acid; clear wavy boundary.

C—31 to 55 inches; brown (7.5YR 5/4) sand; few fine prominent red (2.5YR 4/6) and few medium prominent yellowish red (5YR 5/6) mottles, mostly in the upper 8 inches; single grain; loose; few fine roots; less than 1 percent gravel; strongly acid; abrupt wavy boundary.

2Cg—55 to 58 inches; gray (5Y 5/1) gravelly fine sandy loam; common fine prominent dark red (2.5YR 3/6) and many medium prominent yellowish red (5YR 4/6) and brown (7.5YR 4/3) mottles; massive; friable; few fine roots; about 12 percent gravel and 5 percent cobbles; moderately acid; clear wavy boundary.

2C—58 to 60 inches; brown (7.5YR 4/3) gravelly loamy sand; massive; friable; about 12 percent gravel and 5 percent cobbles; slightly acid.

The thickness of the solum ranges from 22 to 40 inches. Depth to the 2C horizon ranges from 40 to 60 inches. The content of gravel ranges from 0 to 15 percent in the sandy outwash and from 5 to 30 percent in the till. The content of cobbles ranges from 0 to 5 percent in the solum and the C horizon and from 0 to 10 percent in the 2C horizon.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 4 inches thick. The E and Bs horizons are sand or loamy sand. The 2C horizon is sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy sand.

Crystal Lake Series

The Crystal Lake series consists of moderately well drained soils that formed in dominantly silty lacustrine deposits. These soils are in glacial lake basins. Permeability is moderate in the upper part of the profile and moderately slow in the lower part. Slope ranges from 1 to 15 percent.

Typical pedon of Crystal Lake silt loam, 1 to 6 percent slopes, approximately 200 feet west and 2,180 feet north of the southeast corner of sec. 21, T. 34 N., R. 8 E.

A—0 to 3 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many fine roots; moderately acid; abrupt wavy boundary.

E—3 to 4 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium platy structure; friable; many fine roots; common faint very dark gray (10YR 5/1) wormcasts; moderately acid; abrupt broken boundary.

Bw1—4 to 7 inches; dark yellowish brown (10YR 3/4) silt loam; weak very fine subangular blocky structure; very friable; many fine roots; moderately acid; clear wavy boundary.

Bw2—7 to 11 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; very friable; many fine roots; strongly acid; abrupt wavy boundary.

B/E—11 to 18 inches; about 70 percent reddish brown (2.5YR 4/4) silty clay loam (Bt); moderate medium angular blocky structure; firm; common faint dark reddish brown (2.5YR 3/4) clay films on faces of peds and many distinct reddish brown (5YR 5/3) clay films in pores; few prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; penetrated by brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; common fine prominent yellowish red (5YR 5/6) mottles; weak medium platy structure; friable; common fine roots; strongly acid; clear wavy boundary.

Bt1—18 to 30 inches; reddish brown (2.5YR 4/4) silty clay loam; few fine distinct red (2.5YR 4/6) mottles; moderate medium prismatic structure parting to

moderate medium angular blocky; firm; tends to part along horizontal cleavage planes inherited from the parent material; common fine roots; many faint dark reddish brown (2.5YR 3/4) clay films on faces of peds and many distinct reddish brown (5YR 5/3) clay films in pores; common fine and medium prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; common prominent brown (10YR 5/3) coatings of silt on faces of prisms; very strongly acid; clear wavy boundary.

Bt2—30 to 38 inches; reddish brown (5YR 4/3) silty clay loam; common fine prominent red (2.5YR 4/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; common distinct dark reddish brown (2.5YR 3/4) clay films on faces of peds and many faint reddish brown (5YR 5/3) clay films in pores; common fine faint dark reddish brown (2.5YR 2/2) concretions of iron and manganese oxide; common prominent brown (10YR 5/3) coatings of silt on faces of prisms; very strongly acid; gradual wavy boundary.

Bt3—38 to 58 inches; reddish brown (5YR 5/3) silt loam that has a few thin strata of reddish brown (5YR 4/3) silty clay loam and strong brown (7.5YR 4/6) fine sand; common medium faint yellowish red (5YR 5/6) and few fine prominent grayish brown (2.5Y 5/2) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; few distinct dark reddish brown (2.5YR 3/4) clay films on faces of peds and many in pores; common fine and medium distinct dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; common prominent brown (10YR 5/3) coatings of silt on faces of prisms; strongly acid; clear smooth boundary.

C—58 to 60 inches; brown (7.5YR 5/3) silt loam that has a few thin strata of reddish brown (5YR 5/3) silty clay loam and strong brown (7.5YR 4/6) fine sand; many fine prominent yellowish red (5YR 4/6) and common fine prominent dark reddish brown (2.5YR 3/4) and grayish brown (2.5Y 5/2) mottles; massive; friable; tends to part along horizontal cleavage planes inherited from the parent material; few roots; strongly acid.

The thickness of the solum ranges from 30 to 60 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 2 to 5 inches thick. The Bt3 and C horizons are dominantly silt loam but have thin strata of silty clay loam, silt, loam, fine sandy loam, very fine sandy loam, fine sand, very fine sand, loamy fine sand, or loamy very fine sand.

Dawson Series

The Dawson series consists of very poorly drained soils that formed in organic material over sandy deposits. These soils are on outwash plains and moraines. Permeability is moderately rapid to moderately slow in the organic material and rapid in the mineral deposits. Slope is 0 to 1 percent.

Typical pedon of Dawson peat, in an area of Loxley and Dawson peats, 0 to 1 percent slopes, approximately 2,370 feet west and 1,420 feet north of the southeast corner of sec. 25, T. 35 N., R. 7 E.

Oi—0 to 8 inches; peat, brown (10YR 4/3) broken face, light olive brown (2.5Y 5/4) rubbed, pale yellow (2.5Y 7/4) pressed; about 95 percent fiber, 90 percent rubbed; massive; very friable; tends to part along weaknesses in the fibers; many fine roots; primarily sphagnum fibers; white (10YR 8/2) sodium pyrophosphate extract; about 5 percent dark brown (7.5YR 4/4) wood fragments; extremely acid (pH 3.5 by Truog method); abrupt smooth boundary.

Oa1—8 to 28 inches; muck, dark reddish brown (5YR 2/2) broken face and rubbed, dark reddish brown (5YR 3/2) pressed; about 20 percent fiber, 8 percent rubbed; massive; very friable; few fine roots; primarily herbaceous fibers; brown (10YR 5/3) sodium pyrophosphate extract; about 2 percent dark reddish brown (5YR 3/2) wood fragments; extremely acid (pH 4.0 by Truog method); clear smooth boundary.

Oa2—28 to 36 inches; muck, black (5YR 2/1) broken face and pressed, dark reddish brown (5YR 2/2) rubbed; about 10 percent fiber, 2 percent rubbed; massive; very friable; primarily herbaceous fibers; very dark brown (10YR 2/2) sodium pyrophosphate extract; about 2 percent dark reddish brown (5YR 3/2) wood fragments; extremely acid (pH 4.2 by Truog method); clear smooth boundary.

Oa3—36 to 40 inches; muck, dark reddish brown (5YR 3/3) broken face and pressed, dark reddish brown (5YR 3/2) rubbed; about 30 percent fiber, 5 percent rubbed; massive; very friable; primarily herbaceous fibers; dark brown (10YR 3/3) sodium pyrophosphate extract; extremely acid (pH 4.4 by Truog method); abrupt smooth boundary.

C—40 to 60 inches; dark grayish brown (2.5Y 4/2) sand; single grain; loose; about 5 percent gravel; moderately acid.

The organic material is 16 to 51 inches thick. A surface cover of sphagnum moss ranges from 0 to 8

inches in thickness. The content of wood fragments in the organic material ranges from 0 to 5 percent.

The peat has hue of 10YR or 2.5Y and value and chroma of 3 to 6. The muck has hue of 5YR, 7.5YR, or 10YR, or it is neutral in hue and has value of 2 or 3. Some pedons have a few thin layers of mucky peat within the muck. The C horizon is sand, gravelly sand, loamy sand, or gravelly loamy sand. The content of gravel in this horizon ranges from 0 to 35 percent.

Fordum Series

The Fordum series consists of poorly drained and very poorly drained soils that formed in loamy alluvial deposits over sandy alluvial deposits. These soils are on flood plains. Permeability is moderate or moderately rapid in the upper part of the profile and rapid or very rapid in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Fordum loam, 0 to 2 percent slopes, approximately 460 feet east and 100 feet north of the southwest corner of sec. 20, T. 32 N., R. 7 E.

A1—0 to 4 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 4/2) dry; few fine prominent dark brown (7.5YR 4/4) mottles; weak medium granular structure; friable; common fine roots; moderately acid; clear smooth boundary.

A2—4 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; common fine faint very dark gray (10YR 3/1), few fine prominent dark brown (7.5YR 4/4), and common fine prominent yellowish red (5YR 4/6) mottles; weak coarse granular structure; friable; few fine roots; common fine and medium prominent black (5YR 2/1) concretions of iron and manganese oxide; few medium hollow tubular prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; moderately acid; clear smooth boundary.

Cg1—9 to 17 inches; dark grayish brown (10YR 4/2) sandy loam that has a few thin discontinuous layers of grayish brown (10YR 5/2) fine sand and very fine sand; few fine prominent dark brown (7.5YR 3/4), common fine faint grayish brown (10YR 5/2), and common medium faint brown (10YR 4/3) mottles; massive; very friable; few fine roots; common uncoated sand grains; few fine and medium prominent black (5YR 2/1) concretions of iron and manganese oxide; about 2 percent gravel; slightly acid; abrupt smooth boundary.

Cg2—17 to 21 inches; dark gray (10YR 4/1) loam that has a few thin discontinuous layers of grayish brown (10YR 5/2) fine sand and very fine sand; few fine prominent dark brown (7.5YR 3/4), common medium faint very dark gray (10YR 3/1), and many medium faint grayish brown (10YR 5/2) mottles; massive; very friable; few fine roots; few wood fragments and twigs; slightly acid; abrupt smooth boundary.

Cg3—21 to 31 inches; very dark gray (10YR 3/1) mucky loam that has a few thin layers of grayish brown (10YR 5/2) fine sand and black (10YR 2/1) muck; massive; very friable; tends to part along horizontal cleavage planes inherited from the parent material; few wood fragments and twigs; slightly acid; abrupt smooth boundary.

Cg4—31 to 60 inches; strata of grayish brown (10YR 5/2) very gravelly sand and sand; single grain; loose; an average of about 25 percent gravel; neutral.

Depth to the Cg4 horizon ranges from 24 to 40 inches. The content of gravel ranges from 0 to 15 percent in the loamy alluvial deposits and from 0 to 60 percent in the sandy alluvial deposits. The content of cobbles ranges from 0 to 10 percent in the sandy alluvial deposits.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 to 3. It is 6 to 9 inches thick. The strata in the loamy alluvial deposits vary in texture and thickness but commonly consist of loamy deposits stratified with thin layers of sandy deposits and muck. The strata in the sandy alluvial deposits are sand, gravelly sand, or very gravelly sand.

Freeon Series

The Freeon series consists of moderately well drained soils that formed in silty deposits and in the underlying dense loamy glacial till. These soils are on moraines and drumlins and in glacial lake basins on morainic landscapes. Permeability is moderate in the silty upper part of the profile, slow or moderately slow in the loamy subsoil, and very slow in the substratum. Slope ranges from 2 to 15 percent.

Typical pedon of Freeon silt loam, 2 to 6 percent slopes, approximately 1,050 feet east and 70 feet south of the northwest corner of sec. 36, T. 31 N., R. 4 E.

A—0 to 1 inch; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; very friable; many fine roots; about 2 percent gravel and 3 percent cobbles; moderately acid; abrupt wavy boundary.

E—1 to 4 inches; brown (7.5YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak medium platy structure; very friable; many fine roots; about 2 percent gravel and 3 percent cobbles; very strongly acid; abrupt wavy boundary.

Bw—4 to 11 inches; dark yellowish brown (10YR 4/4) silt loam; weak very fine subangular blocky structure; very friable; many fine roots; few distinct brown (7.5YR 4/2) wormcasts; about 5 percent gravel and 3 percent cobbles; very strongly acid; clear wavy boundary.

E/B—11 to 20 inches; about 60 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak thin platy structure; very friable; extends into and surrounds remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; friable; few faint dark yellowish brown (10YR 3/4) clay films on faces of peds; continuous faint brown (10YR 5/3) silt and sand coatings in pores; many fine roots; about 5 percent gravel and 3 percent cobbles; very strongly acid; abrupt wavy boundary.

2B/E—20 to 31 inches; about 70 percent dark brown (7.5YR 4/4) sandy loam (2Bt); few fine prominent dark red (2.5YR 3/6) and common medium prominent yellowish red (5YR 5/6) mottles; moderate fine subangular blocky structure; friable; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds and common clay bridges between mineral grains; penetrated by brown (7.5YR 5/3) sandy loam (2E), very pale brown (10YR 7/3) dry; weak thin platy structure; very friable; common fine roots; about 10 percent gravel and 4 percent cobbles; strongly acid; clear wavy boundary.

2Bt—31 to 42 inches; reddish brown (5YR 4/3) sandy loam; common fine distinct yellowish red (5YR 4/6) and pinkish gray (7.5YR 6/2) mottles; weak coarse prismatic structure parting to moderate fine and medium angular blocky; firm; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots primarily along vertical faces of prisms; common faint dark reddish gray (5YR 4/2) clay films on faces of peds and many in pores; few distinct very dusky red (2.5YR 2/2) coatings of iron and manganese oxide on faces of peds; gray (7.5YR 6/2) mottles are mostly in the upper 6 inches; common distinct brown (7.5YR 5/3) coatings of sand primarily on vertical faces of peds; about 12 percent gravel and 2 percent cobbles; strongly acid; gradual irregular boundary.

2Cd—42 to 60 inches; reddish brown (5YR 4/4) sandy loam; few fine distinct yellowish red (5YR 4/6) mottles; massive; firm; about 9 percent gravel and 3 percent cobbles; strongly acid.

The thickness of the solum ranges from 40 to 90 inches. The silty mantle is 12 to 36 inches thick. The content of gravel ranges from 0 to 10 percent in the silty mantle and from 5 to 35 percent in the till. The content of cobbles ranges from 0 to 5 percent in the silty mantle and from 0 to 10 percent in the till.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 1 to 5 inches thick. The 2B/E and 2Bt horizons commonly are sandy loam, gravelly sandy loam, or loam, but in some pedons they are loamy sand, gravelly loamy sand, fine sandy loam, or gravelly fine sandy loam. The 2Cd horizon commonly is sandy loam or gravelly sandy loam, but in some pedons it is loam, fine sandy loam, or gravelly fine sandy loam.

Goodman Series

The Goodman series consists of well drained, moderately permeable soils that formed in silty deposits and in the underlying friable loamy glacial till. These soils are on moraines and in glacial lake basins on morainic landscapes. Slope ranges from 6 to 15 percent.

Typical pedon of Goodman silt loam, 6 to 15 percent slopes, approximately 60 feet north and 900 feet east of the southwest corner of sec. 35, T. 34 N., R. 7 E.

A—0 to 5 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many fine roots; about 3 percent gravel and 2 percent cobbles; moderately acid; abrupt wavy boundary.

E—5 to 6 inches; brown (7.5YR 5/2) silt loam, pinkish gray (7.5YR 7/2) dry; weak medium platy structure; very friable; many fine roots; many distinct very dark gray (10YR 3/1) wormcasts; about 3 percent gravel and 1 percent cobbles; very strongly acid; abrupt broken boundary.

Bs1—6 to 9 inches; dark brown (7.5YR 3/4) silt loam; weak very fine subangular blocky structure; very friable; many fine roots; about 3 percent gravel and 1 percent cobbles; strongly acid; clear wavy boundary.

Bs2—9 to 15 inches; dark brown (7.5YR 4/4) silt loam; weak very fine subangular blocky structure; very friable; many fine roots; about 3 percent gravel and 1 percent cobbles; strongly acid; clear wavy boundary.

E/B—15 to 24 inches; about 80 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; extends into and surrounds remnants of dark brown (7.5YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; friable; few faint dark brown (7.5YR 3/4) clay films on faces of peds; common fine roots; about 4 percent gravel and 1 percent cobbles; strongly acid; clear wavy boundary.

2B/E—24 to 34 inches; about 60 percent reddish brown (5YR 4/4) sandy loam (2Bt); moderate medium

subangular blocky structure; friable; common faint dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; penetrated by brown (7.5YR 5/3) sandy loam (2E), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; few fine roots; about 11 percent gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

2Bt—34 to 50 inches; reddish brown (5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; few faint dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; about 11 percent gravel and 3 percent cobbles; moderately acid; gradual wavy boundary.

2C—50 to 60 inches; reddish brown (5YR 4/4) sandy loam; massive; friable; about 11 percent gravel and 3 percent cobbles; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. The silty mantle is 12 to 30 inches thick. The content of gravel ranges from 0 to 5 percent in the silty mantle and from 3 to 30 percent in the till. The content of cobbles ranges from 0 to 10 percent throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 1 to 5 inches thick. The 2B/E horizon is loam, fine sandy loam, sandy loam, or gravelly sandy loam. The 2Bt and 2C horizons are sandy loam or gravelly sandy loam.

Goodwit Series

The Goodwit series consists of moderately well drained, moderately permeable soils that formed in silty deposits and in the underlying friable loamy glacial till. These soils are on moraines and in glacial lake basins on morainic landscapes. Slope ranges from 2 to 6 percent.

Typical pedon of Goodwit silt loam, 2 to 6 percent slopes, approximately 60 feet north and 150 feet west of the southeast corner of sec. 27, T. 34 N., R. 7 E.

A—0 to 2 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; about 3 percent gravel and 2 percent cobbles; strongly acid; abrupt wavy boundary.

E—2 to 3 inches; brown (7.5YR 5/2) silt loam, pinkish gray (7.5YR 7/2) dry; weak medium platy structure; very friable; many fine roots; common distinct very dark gray (10YR 3/1) wormcasts; about 3 percent gravel and 1 percent cobbles; very strongly acid; abrupt broken boundary.

Bs1—3 to 6 inches; dark brown (7.5YR 3/4) silt loam; weak very fine subangular blocky structure; very friable; many fine roots; about 3 percent gravel and 1 percent cobbles; very strongly acid; clear wavy boundary.

Bs2—6 to 15 inches; dark brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; very friable; many fine roots; about 3 percent gravel and 1 percent cobbles; strongly acid; clear wavy boundary.

2E—15 to 18 inches; brown (10YR 5/3) fine sandy loam, very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; common fine roots; about 5 percent gravel and 3 percent cobbles; very strongly acid; clear wavy boundary.

2E/B—18 to 30 inches; about 80 percent brown (10YR 5/3) fine sandy loam (2E), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; extends into and surrounds remnants of dark yellowish brown (10YR 4/4) fine sandy loam (2Bt); few fine prominent strong brown (7.5YR 5/6) mottles along root channels; moderate fine subangular blocky structure; friable; few prominent dark reddish brown (5YR 3/4) clay films on faces of peds; common fine roots; about 7 percent gravel and 3 percent cobbles; very strongly acid; clear wavy boundary.

2B/E—30 to 36 inches; about 70 percent dark brown (7.5YR 4/4) sandy loam (2Bt); common medium prominent yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds and common clay bridges between mineral grains; many distinct reddish brown (5YR 5/3) clay films in pores; penetrated by brown (10YR 5/3) sandy loam (2E), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; few fine roots; about 8 percent gravel and 4 percent cobbles; moderately acid; clear wavy boundary.

2Bt—36 to 50 inches; dark brown (7.5YR 4/4) sandy loam; few fine prominent yellowish red (5YR 4/6 and 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; about 10 percent gravel and 4 percent cobbles; moderately acid; gradual wavy boundary.

2C—50 to 60 inches; reddish brown (5YR 4/3) sandy loam; massive; friable; about 11 percent gravel and 3 percent cobbles; moderately acid.

The thickness of the solum ranges from 30 to 60 inches. The silty mantle is 12 to 30 inches thick. The content of gravel ranges from 0 to 5 percent in the silty

mantle and from 3 to 30 percent in the till. The content of cobbles ranges from 0 to 10 percent throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 1 to 5 inches thick. The 2E, 2E/B, and 2B/E horizons are loam, fine sandy loam, sandy loam, or gravelly sandy loam. The 2Bt and 2C horizons are sandy loam or gravelly sandy loam.

Hatley Series

The Hatley series consists of somewhat poorly drained, moderately permeable soils that formed in silty deposits and in the underlying friable loamy glacial till. These soils are on moraines. Slope ranges from 0 to 4 percent.

Typical pedon of Hatley silt loam, 0 to 4 percent slopes, approximately 40 feet south and 1,700 feet east of the northwest corner of sec. 35, T. 34 N., R. 7 E.

A—0 to 3 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; many fine roots; about 3 percent gravel and 2 percent cobbles; strongly acid; abrupt wavy boundary.

E—3 to 6 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; few fine prominent red (2.5YR 4/6) and common fine prominent yellowish red (5YR 5/6) mottles; moderate thin platy structure; very friable; many fine roots; common distinct very dark gray (10YR 3/1) wormcasts; about 3 percent gravel and 2 percent cobbles; very strongly acid; clear wavy boundary.

E/B—6 to 14 inches; about 80 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; very friable; surrounds remnants of dark brown (7.5YR 4/4) silt loam (Bt); few fine prominent red (2.5YR 4/6), common medium prominent grayish brown (2.5Y 5/2), and many fine prominent yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; friable; few prominent dark reddish brown (2.5YR 3/4) clay films on faces of peds; common fine roots; few fine and medium prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; about 4 percent gravel and 2 percent cobbles; very strongly acid; clear wavy boundary.

2B/E—14 to 21 inches; about 60 percent dark brown (7.5YR 4/4) loam (2Bt); common fine prominent red (2.5YR 4/6), common medium prominent grayish brown (10YR 5/2), and many medium prominent yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; friable; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; penetrated by brown (10YR 5/3) loam (2E), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; common fine roots; common fine and medium prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; about 6 percent gravel and 2 percent cobbles; strongly acid; clear wavy boundary.

2Bt1—21 to 32 inches; reddish brown (5YR 4/3) sandy loam; few fine prominent dark red (2.5YR 3/6), few medium distinct brown (7.5YR 5/2), and common medium distinct yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; many distinct weak red (2.5YR 4/2) clay films on faces of peds and many distinct dusky red (2.5YR 3/2) clay films in pores; common fine prominent black (5YR 2/1) concretions of iron and manganese oxide; about 8 percent gravel and 5 percent cobbles; strongly acid; gradual wavy boundary.

2Bt2—32 to 46 inches; reddish brown (5YR 5/3) sandy loam; few medium distinct yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few faint dark reddish gray (5YR 4/2) clay films on faces of peds and common clay bridges between mineral grains; few fine prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; about 8 percent gravel and 5 percent cobbles; moderately acid; gradual wavy boundary.

2C—46 to 60 inches; reddish brown (5YR 5/3) sandy loam; massive; friable; about 8 percent gravel and 5 percent cobbles; moderately acid.

The thickness of the solum ranges from 40 to 60 inches. The silty mantle is 12 to 30 inches thick. The content of gravel ranges from 0 to 15 percent in the silty mantle and from 5 to 25 percent in the till. The content of cobbles ranges from 0 to 10 percent throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 2 to 5 inches thick. The 2B/E horizon is loam, fine sandy loam, sandy loam, or gravelly sandy loam. The 2Bt and 2C horizons are sandy loam or gravelly sandy loam.

Keweenaw Series

The Keweenaw series consists of well drained soils that formed in dominantly sandy glacial drift. These soils are on moraines. Permeability is moderate or moderately rapid. Slope ranges from 6 to 35 percent.

Typical pedon of Keweenaw sandy loam, 15 to 35 percent slopes, approximately 80 feet east and 1,810

feet south of the northwest corner of sec. 18, T. 34 N., R. 8 E.

A—0 to 2 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; moderate fine granular structure; very friable; many fine roots; about 5 percent gravel and 3 percent cobbles; moderately acid; abrupt wavy boundary.

E—2 to 4 inches; brown (7.5YR 4/2) sandy loam, brown (7.5YR 5/2) dry; weak very fine subangular blocky structure; very friable; many fine roots; few distinct very dark gray (10YR 3/1) wormcasts; about 5 percent gravel and 3 percent cobbles; strongly acid; clear broken boundary.

Bs1—4 to 10 inches; dark reddish brown (5YR 3/4) sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; about 11 percent gravel and 3 percent cobbles; strongly acid; clear broken boundary.

Bs2—10 to 16 inches; reddish brown (5YR 4/4) sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; about 11 percent gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

Bs3—16 to 20 inches; dark brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; many fine roots; about 11 percent gravel and 3 percent cobbles; moderately acid; clear wavy boundary.

E′—20 to 27 inches; brown (7.5YR 5/4) loamy sand, light brown (7.5YR 6/4) dry; weak medium platy structure; very friable; many fine roots; about 11 percent gravel and 2 percent cobbles; moderately acid; clear broken boundary.

E/B—27 to 43 inches; 70 percent brown (7.5YR 5/3) sand (E′), pink (5YR 7/3) dry; single grain; loose; surrounds 25 percent isolated remnants of reddish brown (2.5YR 4/4) loamy sand (Bt) and 5 percent isolated remnants of dark reddish brown (2.5YR 3/4) sandy loam (Bt); moderate fine subangular blocky structure; friable; few faint dark reddish brown (2.5YR 2/4) clay films on faces of peds and many clay bridges between mineral grains in the sandy loam; common clay bridges between mineral grains in the loamy sand; common fine roots; about 13 percent gravel and 1 percent cobbles; moderately acid; gradual irregular boundary.

B/E1—43 to 54 inches; about 40 percent reddish brown (2.5YR 4/4) loamy sand (Bt) and 25 percent isolated peds of dark reddish brown (2.5YR 3/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; common faint dark reddish brown (2.5YR 2/4) clay films on faces of peds, many faint reddish brown (2.5YR 5/4) clay films in pores in the sandy loam, and common clay bridges between mineral grains in the loamy sand and many in the sandy loam; penetrated by brown (7.5YR 5/3) sand (E′), pink (5YR 7/3) dry; single grain; loose; common fine roots; common uncoated sand grains on vertical faces of peds; about 8 percent gravel and 2 percent cobbles; moderately acid; gradual irregular boundary.

B/E2—54 to 75 inches; about 90 percent reddish brown (2.5YR 4/4) loamy sand (Bt); weak medium and coarse subangular blocky structure; very friable; common faint dark reddish brown (2.5YR 3/4) clay bridges between mineral grains; fingers of brown (7.5YR 5/3) sand (E′), pink (5YR 7/3) dry; single grain; loose; few fine roots; about 10 percent gravel and 2 percent cobbles; moderately acid; diffuse irregular boundary.

C—75 to 99 inches; reddish brown (2.5YR 4/4) loamy sand; massive; very friable; few fine roots; about 10 percent gravel and 2 percent cobbles; slightly acid.

The thickness of the solum ranges from 40 to 90 inches. The content of gravel ranges from 0 to 15 percent in the upper part of the solum and from 0 to 25 percent in the lower part of the solum and in the substratum. The content of cobbles ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3 and chroma of 0. It is 0 to 4 inches thick. The A, Bs1, and Bs2 horizons are loamy sand or sandy loam. The E horizon is sand, loamy sand, or sandy loam. The Bs3 horizon is sand or loamy sand. The Bt part of the solum is loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam. The E′ part of the solum and the C horizon commonly are sand, gravelly sand, loamy sand, or gravelly loamy sand.

Loxley Series

The Loxley series consists of very poorly drained soils that formed in organic material. These soils are on outwash plains, in glacial lake basins, and on moraines. Permeability is moderately rapid to moderately slow. Slope is 0 to 1 percent.

Typical pedon of Loxley peat, in an area of Loxley and Dawson peats, 0 to 1 percent slopes, approximately 150 feet east and 2,050 feet south of the northwest corner of sec. 18, T. 35 N., R. 7 E.

Oi—0 to 10 inches; peat, light olive brown (2.5Y 5/4) broken face, olive brown (2.5Y 4/4) rubbed, pale yellow (2.5Y 7/4) pressed; about 95 percent fiber, 90 percent rubbed; massive; very friable; many fine roots; primarily sphagnum fibers; white (10YR 8/2)

sodium pyrophosphate extract; about 2 percent leatherleaf twigs; extremely acid (pH 3.7 by Truog method); clear smooth boundary.

Oe—10 to 20 inches; mucky peat, very dark grayish brown (2.5Y 3/2) broken face, very dark brown (10YR 2/2) rubbed, dark grayish brown (2.5Y 4/2) pressed; about 70 percent fiber, 40 percent rubbed; massive; very friable; few fine roots; primarily sphagnum fibers; very pale brown (10YR 8/4) sodium pyrophosphate extract; about 3 percent leatherleaf twigs; extremely acid (pH 3.7 by Truog method); clear smooth boundary.

Oa1—20 to 45 inches; muck, dark reddish brown (5YR 3/2) broken face and rubbed, dark reddish brown (5YR 3/3) pressed; about 50 percent fiber, 10 percent rubbed; massive; very friable; tends to part along weaknesses in the fibers; primarily herbaceous fibers; light yellowish brown (10YR 6/4) sodium pyrophosphate extract; about 1 percent dark brown (7.5YR 4.4) wood fragments; extremely acid (pH 3.5 by Truog method); gradual smooth boundary.

Oa2—45 to 60 inches; muck, dark reddish brown (5YR 2/2) broken face, dark reddish brown (5YR 3/2) rubbed and pressed; about 40 percent fiber, 15 percent rubbed; massive; very friable; tends to part along weaknesses in the fibers; primarily herbaceous fibers; very pale brown (10YR 7/4) sodium pyrophosphate extract; about 1 percent dark brown (7.5YR 4/4) wood fragments; extremely acid (pH 3.8 by Truog method).

The organic material is more than 51 inches thick. A surface cover of sphagnum moss ranges from 0 to 8 inches in thickness. The content of wood fragments ranges from 0 to 5 percent.

The peat has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 3 or 4. The mucky peat has hue of 5YR, 7.5YR, 10YR, or 2.5Y, value of 2 to 4, and chroma of 1 to 4. The muck has hue of 5YR, 7.5YR, or 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3. Some pedons have a few thin layers of mucky peat within the muck.

Lupton Series

The Lupton series consists of very poorly drained soils that formed in organic material. These soils are on outwash plains, in glacial lake basins, and on moraines. Permeability is moderately rapid to moderately slow. Slope is 0 to 1 percent.

Typical pedon of Lupton muck, in an area of Lupton, Cathro, and Markey mucks, 0 to 1 percent slopes, approximately 1,500 feet north and 800 feet east of the southwest corner of sec. 8, T. 35 N., R. 8 E.

Oa1—0 to 24 inches; muck, dark reddish brown (5YR 2/2) broken face and pressed, black (5YR 2/1) rubbed; about 30 percent fiber, 10 percent rubbed; weak fine subangular blocky structure; very friable; many fine roots; herbaceous and woody fibers; brown (10YR 5/3) sodium pyrophosphate extract; about 10 percent dark reddish brown (5YR 3/3) wood fragments; slightly acid (pH 6.2 by Truog method); clear smooth boundary.

Oa2—24 to 45 inches; muck, black (5YR 2/1) broken face and rubbed, dark reddish brown (5YR 2/2) pressed; about 15 percent fiber, 3 percent rubbed; massive; very friable; herbaceous and woody fibers; dark grayish brown (10YR 4/2) sodium pyrophosphate extract; about 5 percent dark reddish brown (5YR 3/3) wood fragments; moderately acid (pH 5.9 by Truog method); clear smooth boundary.

Oa3—45 to 60 inches; muck, dark reddish brown (5YR 3/2) broken face, dark reddish brown (5YR 2/2) rubbed, dark brown (7.5YR 3/2) pressed; about 20 percent fiber, 8 percent rubbed; massive; very friable; herbaceous and woody fibers; dark brown (10YR 4/3) sodium pyrophosphate extract; about 10 percent dark reddish brown (5YR 3/3) wood fragments; moderately acid (pH 5.9 by Truog method).

The organic material is more than 51 inches thick. Many pedons have a surface cover of sphagnum moss as much as 4 inches thick. The content of wood fragments ranges from 0 to 15 percent.

The muck has hue of 5YR, 7.5YR, or 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3 and chroma of 0. Some pedons have a few thin layers of mucky peat.

Magnor Series

The Magnor series consists of somewhat poorly drained soils that formed in silty deposits and in the underlying dense loamy glacial till. These soils are on moraines and drumlins and in glacial lake basins on morainic landscapes. Permeability is moderate in the silty upper part of the profile, slow or moderately slow in the loamy subsoil, and very slow in the substratum. Slope ranges from 0 to 4 percent.

Typical pedon of Magnor silt loam, 0 to 4 percent slopes, approximately 100 feet south and 1,110 feet east of the northwest corner of sec. 30, T. 32 N., R. 8 E.

A—0 to 5 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; many fine roots; about 3 percent gravel and 5 percent cobbles; very

strongly acid; abrupt wavy boundary.

E—5 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; few fine prominent yellowish brown (10YR 5/6) mottles; weak medium platy structure; very friable; many fine roots; few faint very dark gray (10YR 3/1) wormcasts; about 2 percent gravel and 3 percent cobbles; very strongly acid; clear wavy boundary.

E/B—10 to 15 inches; about 70 percent grayish brown (10YR 5/2) silt loam (E), light gray (10YR 7/2) dry; moderate thin platy structure; very friable; extends into and surrounds remnants of yellowish brown (10YR 5/4) silt loam (Bt); common fine prominent yellowish red (5YR 4/6), common medium distinct light brownish gray (10YR 6/2), and common medium prominent strong brown (7.5YR 5/6) mottles; weak very fine subangular blocky structure; friable; few prominent reddish brown (5YR 4/3) clay films on faces of peds; many thin distinct grayish brown (10YR 5/2), uncoated very fine sand grains in pores; common fine roots; about 2 percent gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

B/E—15 to 25 inches; about 60 percent yellowish brown (10YR 5/4) silt loam (Bt); many medium prominent yellowish red (5YR 4/6 and 5/6), many coarse prominent light brownish gray (2.5Y 6/2), and few fine prominent dark red (2.5YR 3/6) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; friable; few prominent reddish brown (5YR 4/3) clay films on faces of peds; many distinct grayish brown (10YR 5/2) coatings of silt and sand in pores and on vertical faces of peds; penetrated by grayish brown (10YR 5/2) silt loam (E), light gray (10YR 7/2) dry; weak medium platy structure; friable; common fine roots; about 2 percent gravel and 3 percent cobbles; strongly acid; abrupt wavy boundary.

2Bt—25 to 39 inches; reddish brown (5YR 4/3) sandy loam; few fine distinct yellowish red (5YR 5/6), common medium distinct yellowish red (5YR 4/6), and common medium faint pinkish gray (5YR 6/2) mottles; moderate coarse prismatic structure parting to moderate fine subangular blocky; firm; tends to part along horizontal cleavage planes inherited from the parent material; common fine roots along vertical faces of prisms; common faint dark reddish gray (5YR 4/2) clay films on faces of peds and many in pores; few fine and medium distinct very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; many distinct brown (7.5YR 5/2) coatings of silt and sand primarily on vertical faces of peds; about 8 percent gravel and 4 percent cobbles; strongly acid; gradual irregular boundary.

2Cd—39 to 60 inches; reddish brown (5YR 4/4) sandy loam; few medium distinct yellowish red (5YR 4/6) mottles; massive; firm; about 8 percent gravel and 4 percent cobbles; slightly acid;

The thickness of the solum ranges from 30 to 70 inches. The silty mantle is 12 to 36 inches thick. The content of gravel ranges from 0 to 10 percent in the silty mantle and from 5 to 35 percent in the till. The content of cobbles ranges from 0 to 5 percent in the silty mantle and from 0 to 10 percent in the till.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 2 to 5 inches thick. The 2Bt horizon commonly is sandy loam, gravelly sandy loam, or loam, but in some pedons it is loamy sand, gravelly loamy sand, fine sandy loam, or gravelly fine sandy loam. The 2Cd horizon commonly is sandy loam or gravelly sandy loam, but in some pedons it is loam, fine sandy loam, or gravelly fine sandy loam.

Magroc Series

The Magroc series consists of somewhat poorly drained, moderately permeable soils on glacial moraines underlain by igneous and metamorphic bedrock. These soils formed in silty deposits and in the underlying loamy glacial till. Slope ranges from 0 to 4 percent.

Typical pedon of Magroc silt loam, 0 to 4 percent slopes, approximately 1,350 feet east and 100 feet north of the southwest corner of sec. 30, T. 32 N., R. 8 E.

A—0 to 4 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many fine roots; about 11 percent gravel and 3 percent cobbles; strongly acid; abrupt wavy boundary.

E—4 to 11 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; few fine prominent yellowish red (5YR 4/6) and common fine prominent strong brown (7.5YR 5/6) mottles; moderate thin platy structure; very friable; common fine roots; about 5 percent gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

E/B—11 to 21 inches; about 70 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate thin platy structure; very friable; extends into and surrounds remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); few fine prominent red (2.5YR 4/6), common fine distinct light brownish gray (10YR 6/2), and common medium prominent yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; friable; few prominent brown (7.5YR 4/2) clay films on faces of peds;

common fine roots; common fine prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; about 5 percent gravel and 3 percent cobbles; very strongly acid; clear wavy boundary.

B/E—21 to 29 inches; about 60 percent dark yellowish brown (10YR 4/4) gravelly silt loam (Bt); few fine prominent dark red (2.5YR 3/6), common medium distinct light brownish gray (2.5YR 6/2), and many medium prominent yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; friable; common prominent dark brown (7.5YR 4/2) clay films on faces of peds and many clay films in pores; penetrated by brown (10YR 5/3) gravelly silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; common fine roots; common fine prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; about 17 percent gravel and 4 percent cobbles; very strongly acid; abrupt wavy boundary.

2Bt—29 to 42 inches; reddish brown (5YR 4/4) gravelly sandy loam; few medium prominent pinkish gray (7.5YR 6/2) and common medium prominent red (2.5YR 4/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; few distinct dark reddish gray (5YR 4/2) clay films on faces of peds; few fine distinct dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; about 14 percent gravel and 5 percent cobbles; moderately acid; abrupt wavy boundary.

3R—42 inches; unweathered, slightly fractured, dark gray (N 4/0) metamorphic bedrock.

The thickness of the solum and the depth to bedrock range from 40 to 60 inches. The silty mantle is 12 to 36 inches thick. The content of gravel ranges from 0 to 10 percent in most of the silty mantle but ranges to 20 percent immediately above the till. The content of gravel ranges from 5 to 30 percent in the till. The content of cobbles ranges from 0 to 10 percent in the silty mantle and from 0 to 30 percent in the till.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 2 to 5 inches thick. The 2B/E and 2Bt horizons commonly are sandy loam, fine sandy loam, loam, or the gravelly or cobbly analogs of those textures.

Markey Series

The Markey series consists of very poorly drained soils that formed in organic material over sandy deposits. These soils are on outwash plains and moraines. Permeability is moderately rapid to moderately slow in the organic material and rapid in the mineral deposits. Slope is 0 to 1 percent.

Typical pedon of Markey muck, in an area of Lupton, Cathro, and Markey mucks, 0 to 1 percent slopes, approximately 600 feet south and 140 feet west of the northeast corner of sec. 20, T. 35 N., R. 6 E.

Oa1—0 to 6 inches; muck, black (5YR 2/1) broken face and pressed, dark reddish brown (5YR 2/2) rubbed; about 25 percent fiber, 8 percent rubbed; weak fine subangular blocky structure; very friable; many fine roots; herbaceous and woody fibers; brown (10YR 5/3) sodium pyrophosphate extract; about 10 percent dark reddish brown (5YR 3/4) wood fragments; moderately acid (pH 5.8 by Truog method); clear smooth boundary.

Oa2—6 to 30 inches; muck, black (5YR 2/1) broken face and pressed, dark reddish brown (5YR 2/2) rubbed; about 10 percent fiber, 5 percent rubbed; massive; very friable; herbaceous and woody fibers; dark grayish brown (10YR 4/2) sodium pyrophosphate extract; about 5 percent dark reddish brown (5YR 3/4) wood fragments; moderately acid (pH 5.8 by Truog method); clear smooth boundary.

Oa3—30 to 36 inches; muck, dark brown (7.5YR 3/2) broken face, very dark brown (10YR 2/2) rubbed and pressed; about 15 percent fiber, 3 percent rubbed; massive; very friable; primarily herbaceous fibers and some woody ones; brown (10YR 5/3) sodium pyrophosphate extract; about 1 percent dark reddish brown (5YR 3/4) wood fragments; strongly acid (pH 5.2 by Truog method); abrupt smooth boundary.

C—36 to 60 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; few dead roots in the upper 2 inches; about 2 percent gravel; moderately acid.

The organic material is 16 to 51 inches thick. Many pedons have a surface cover of sphagnum moss as much as 4 inches thick. The content of wood fragments in the organic material ranges from 0 to 15 percent.

The muck has hue of 5YR, 7.5YR, or 10YR, value of 2 or 3, and chroma of 1 to 3, or it is neutral in hue and has value of 2 or 3 and chroma of 0. Some pedons have a few thin layers of mucky peat within the muck. The C horizon is sand or loamy sand. The content of gravel in the C horizon ranges from 0 to 15 percent.

Mequithy Series

The Mequithy series consists of well drained, moderately permeable soils on glacial moraines underlain by igneous and metamorphic bedrock. These soils formed in silty and loamy deposits and in the underlying glacial drift. Slope ranges from 2 to 15 percent.

Typical pedon of Mequithy silt loam, 6 to 15 percent slopes, approximately 660 feet south and 1,720 feet west of the northeast corner of sec. 33, T. 31 N., R. 7 E.

A—0 to 4 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many fine roots; about 2 percent gravel and 2 percent cobbles; very strongly acid; abrupt wavy boundary.

E—4 to 5 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium platy structure; very friable; many fine roots; many faint very dark gray (10YR 3/1) wormcasts; about 2 percent gravel and 2 percent cobbles; very strongly acid; abrupt broken boundary.

Bs1—5 to 8 inches; dark brown (7.5YR 3/4) silt loam; weak very fine subangular blocky structure; very friable; many fine roots; about 2 percent gravel and 2 percent cobbles; very strongly acid; abrupt wavy boundary.

Bs2—8 to 13 inches; dark brown (7.5YR 4/4) loam; weak fine subangular blocky structure; very friable; many fine roots; about 2 percent gravel and 2 percent cobbles; very strongly acid; clear wavy boundary.

E/B—13 to 19 inches; about 80 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; extends into and surrounds remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); weak fine angular blocky structure; friable; few distinct dark brown (7.5YR 3/4) clay films on faces of peds; common fine roots; about 2 percent gravel and 2 percent cobbles; strongly acid; clear wavy boundary.

B/E—19 to 28 inches; about 70 percent dark yellowish brown (10YR 4/4) silt loam (Bt); moderate fine angular blocky structure; friable; common prominent dark reddish brown (5YR 3/4) clay films on faces of peds; penetrated by brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; common fine roots; about 2 percent gravel and 2 percent cobbles; very strongly acid; gradual wavy boundary.

2Bt—28 to 38 inches; dark brown (7.5YR 4/4) cobbly loam; weak coarse prismatic structure parting to weak medium angular blocky; friable; few fine roots; few distinct dark reddish brown (5YR 3/3) clay films on faces of peds and common clay bridges between mineral grains; common faint brown (7.5YR 5/3) coatings of sand primarily on vertical faces of prisms; about 13 percent gravel and 12 percent cobbles; strongly acid; abrupt irregular boundary.

3R—38 inches; fractured igneous and metamorphic bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of gravel ranges from 0 to 15 percent in the silty or loamy mantle and from 5 to 30 percent in the till. The content of cobbles ranges from 0 to 10 percent in the silty or loamy mantle and from 0 to 30 percent in the till.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 2 to 5 inches thick. The Bs1, Bs2, E/B, and B/E horizons are loam or silt loam. The 2Bt horizon is sandy loam, fine sandy loam, loam, or the gravelly or cobbly analogs of those textures.

Minocqua Series

The Minocqua series consists of very poorly drained soils that formed in silty and loamy deposits and in the underlying sand and gravel. These soils are on outwash plains and in outwash areas on morainic landscapes. Permeability is moderate in the upper part of the profile, moderately rapid or rapid in the lower part of the subsoil, and rapid or very rapid in the substratum. Slope ranges from 0 to 2 percent.

Typical pedon of Minocqua muck, in an area of Minocqua and Capitola mucks, 0 to 2 percent slopes, approximately 1,580 feet north and 60 feet west of the southeast corner of sec. 13, T. 33 N., R. 8 E.

Oa—0 to 4 inches; muck, black (5YR 2/1) broken face and rubbed, black (10YR 2/1) pressed; about 20 percent fiber, 5 percent rubbed; moderate fine granular structure; very friable; many fine roots; primarily herbaceous fibers and some woody ones; about 25 percent mineral ash material; yellowish brown (10YR 5/4) sodium pyrophosphate extract; about 5 percent dark brown (7.5YR 4/4) wood fragments; strongly acid (pH 5.1 by Truog method); abrupt smooth boundary.

A—4 to 5 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; very friable; many fine roots; about 2 percent gravel and 3 percent cobbles; strongly acid; abrupt wavy boundary.

Bg1—5 to 15 inches; gray (5Y 5/1) silt loam; few fine prominent dark red (2.5YR 3/6), common fine distinct grayish brown (2.5Y 5/2), and many fine prominent yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; friable; common fine roots; common fine prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; about 1 percent gravel; strongly acid; clear wavy boundary.

Bg2—15 to 21 inches; greenish gray (5GY 5/1) silt

loam; few fine prominent dark red (2.5YR 3/6), common medium prominent grayish brown (2.5Y 5/2), many fine prominent olive brown (2.5Y 4/4), and many medium prominent yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; friable; a few vertical cleavage planes; few fine roots; many fine and medium prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; about 1 percent gravel; slightly acid; clear wavy boundary.

Bg3—21 to 25 inches; dark greenish gray (5GY 4/1) silt loam; common medium prominent yellowish red (5YR 4/6) mottles adjacent to root channels and few fine prominent dark red (2.5YR 3/6) and common fine prominent olive brown (2.5Y 4/4) mottles; weak coarse subangular blocky structure; friable; few fine roots; few fine prominent dark reddish brown (2.5YR 2/4) concretions of iron and manganese oxide; about 1 percent gravel; slightly alkaline; clear wavy boundary.

2Bg4—25 to 33 inches; greenish gray (5GY 5/1) loam; few medium prominent yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; common fine prominent dark reddish brown (2.5YR 2/4) concretions of iron and manganese oxide; about 2 percent gravel; slightly alkaline; abrupt wavy boundary.

2Bg5—33 to 37 inches; dark gray (5Y 4/1) gravelly sandy loam; few medium prominent yellowish red (5YR 4/6) mottles adjacent to root channels; weak coarse subangular blocky structure; very friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; about 17 percent gravel and 2 percent cobbles; slightly alkaline; abrupt wavy boundary.

3C—37 to 60 inches; dark grayish brown (10YR 4/2) very gravelly sand; single grain; loose; about 39 percent gravel and 3 percent cobbles; slightly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The silty mantle ranges from 0 to 30 inches in thickness. The content of gravel ranges from 0 to 35 percent in the silty or loamy mantle but is typically less than 15 percent in the upper part. The content of gravel ranges from 3 to 50 percent in the 3C horizon as an average, but it ranges from 0 to 65 percent in individual strata. The content of cobbles ranges from 0 to 5 percent throughout the profile.

The Oa horizon has hue of 5YR, 7.5YR, or 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral in hue and has value of 2 or 3. It is 2 to 6 inches thick.

The A and Bg horizons are typically silt loam. In pedons that do not have a silty mantle, the A and Bg horizons are loam or sandy loam. Some pedons have a 3Bg horizon (or a 2Bg horizon in pedons that do not have a silty mantle). This horizon is sand, coarse sand, loamy sand, loamy coarse sand, or the gravelly, very gravelly, or extremely gravelly analogs of those textures. The strata in the 3C horizon, or in the 2C horizon in pedons that do not have a silty mantle, are sand or coarse sand or the gravelly, very gravelly, or extremely gravelly analogs of those textures.

Moodig Series

The Moodig series consists of somewhat poorly drained, moderately permeable soils that formed in dominantly friable loamy glacial till. These soils are on moraines and drumlins. Slope ranges from 0 to 4 percent.

Typical pedon of Moodig sandy loam, 0 to 4 percent slopes, approximately 990 feet south and 550 feet west of the northeast corner of sec. 4, T. 35 N., R. 5 E.

A—0 to 3 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many fine roots; common uncoated sand grains; few wood charcoal fragments; about 8 percent gravel and 5 percent cobbles; very strongly acid; abrupt wavy boundary.

E—3 to 5 inches; brown (7.5YR 5/2) gravelly sandy loam, pinkish gray (7.5YR 7/2) dry; weak medium platy structure; very friable; many fine roots; common very dark gray (10YR 3/1) and dark brown (7.5YR 3/3) wormcasts; about 12 percent gravel and 5 percent cobbles; extremely acid; abrupt broken boundary.

Bhs—5 to 9 inches; dark brown (7.5YR 3/3) gravelly sandy loam; weak very fine subangular blocky structure; very friable; many coarse roots; about 22 percent gravel and 5 percent cobbles; extremely acid; clear wavy boundary.

Bs—9 to 14 inches; dark brown (7.5YR 3/4) gravelly sandy loam; few fine prominent dark reddish brown (2.5YR 2/4) mottles; weak fine subangular blocky structure; very friable; many fine roots; few prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; about 16 percent gravel and 5 percent cobbles; very strongly acid; clear wavy boundary.

Bw—14 to 22 inches; dark brown (7.5YR 4/4) sandy loam; few fine prominent dark reddish brown (2.5YR 3/4) and common medium distinct yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; friable; common fine roots; few prominent dark reddish brown (5YR 2/2) concretions of iron

and manganese oxide; about 9 percent gravel and 3 percent cobbles; very strongly acid; clear irregular boundary.

E/B—22 to 33 inches; about 70 percent brown (10YR 5/3) loamy sand and sandy loam (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; extends into and surrounds remnants of dark brown (7.5YR 4/4) sandy loam (Bt); common fine prominent dark red (2.5YR 3/6), common medium prominent grayish brown (10YR 5/2), and many medium prominent yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; friable; few prominent dark reddish brown (2.5YR 3/4) clay films on faces of peds; few fine roots; about 11 percent gravel and 3 percent cobbles; strongly acid; abrupt wavy boundary.

B/E—33 to 53 inches; about 60 percent dark brown (7.5YR 4/3) gravelly sandy loam (Bt); few medium distinct brown (10YR 5/3) and common coarse prominent yellowish red (5YR 4/6) mottles; moderate medium plates inherited from the parent material parting to moderate very fine angular blocky structure; friable; few distinct reddish brown (5YR 4/3) clay films on faces of peds; penetrated by brown (7.5YR 5/3) gravelly loamy sand and gravelly sandy loam (E′), pink (7.5YR 7/3) dry; weak medium platy structure; very friable; few fine roots; many uncoated sand grains on faces of plates; few thin broken layers of grayish brown (2.5Y 5/2) sandy loam; about 17 percent gravel and 5 percent cobbles; moderately acid; gradual wavy boundary.

Bt—53 to 73 inches; brown (7.5YR 4/3) gravelly sandy loam; few medium prominent yellowish red (5YR 4/6) mottles; moderate medium plates inherited from the parent material parting to moderate very fine angular blocky structure; firm; common distinct reddish brown (5YR 4/3) clay films on faces of peds; common uncoated sand grains on faces of plates; about 23 percent gravel and 5 percent cobbles; slightly acid; gradual wavy boundary.

C—73 to 95 inches; brown (7.5YR 4/3) gravelly sandy loam; massive; friable; about 22 percent gravel and 10 percent cobbles; slightly acid.

The thickness of the solum ranges from 30 to 75 inches. The content of gravel ranges from 0 to 35 percent throughout the profile. The content of cobbles ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E, Bhs, and Bs horizons are sandy loam, fine sandy loam, or loam. The Bt part of the solum is sandy loam, gravelly sandy loam, or loam. The C horizon and the E′ part of the E/B and B/E horizons are loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam.

Newood Series

The Newood series consists of moderately well drained soils that formed in dominantly dense loamy glacial till. These soils are on moraines and drumlins. Permeability is moderate in the upper part of the profile, slow in the lower part of the subsoil, and very slow in the substratum. Slope ranges from 2 to 15 percent.

Typical pedon of Newood sandy loam, 6 to 15 percent slopes, approximately 390 feet east and 2,310 feet north of the southwest corner of sec. 31, T. 32 N., R. 6 E.

A—0 to 4 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; many fine roots; about 11 percent gravel and 2 percent cobbles; moderately acid; abrupt wavy boundary.

E—4 to 5 inches; brown (7.5YR 4/2) gravelly sandy loam, pinkish gray (7.5YR 6/2) dry; weak medium platy structure; very friable; many fine roots; few distinct very dark gray (10YR 3/1) wormcasts; about 14 percent gravel and 2 percent cobbles; strongly acid; abrupt broken boundary.

Bs1—5 to 8 inches; dark brown (7.5YR 3/4) gravelly sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; about 19 percent gravel and 4 percent cobbles; strongly acid; clear broken boundary.

Bs2—8 to 13 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak fine subangular blocky structure; very friable; many fine roots; about 19 percent gravel and 4 percent cobbles; strongly acid; clear wavy boundary.

E′—13 to 17 inches; brown (7.5YR 5/3) gravelly sandy loam, pinkish gray (7.5YR 6/2) dry; weak medium platy structure; very friable; many fine roots; about 13 percent gravel and 4 percent cobbles; strongly acid; clear broken boundary.

E/B—17 to 29 inches; about 80 percent brown (7.5YR 5/3) gravelly sandy loam (E′), pinkish gray (7.5YR 6/2) dry; weak medium platy structure; very friable; extends into and surrounds isolated remnants of reddish brown (5YR 4/4) gravelly sandy loam (Bt); moderate fine subangular blocky structure; friable; few faint dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; common fine roots; about 19 percent gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

B/E—29 to 37 inches; about 70 percent reddish brown (5YR 4/4) gravelly sandy loam (Bt); moderate fine

subangular blocky structure; friable; common faint dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; penetrated by brown (7.5YR 5/3) gravelly sandy loam (E′), pinkish gray (7.5YR 6/2) dry; weak medium platy structure; very friable; common fine roots; many distinct brown (7.5YR 5/3) coatings of sand in pores; about 13 percent gravel and 2 percent cobbles; moderately acid; clear wavy boundary.

Bt1—37 to 46 inches; reddish brown (5YR 4/4) gravelly sandy loam; common fine distinct yellowish red (5YR 4/6) mottles; strong fine and very fine angular blocky structure; firm; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; many faint dark reddish brown (5YR 3/4) clay films on faces of peds, many clay bridges between mineral grains, and many clay films in pores; common distinct brown (7.5YR 5/3) coatings of sand primarily on vertical faces of peds; about 14 percent gravel and 2 percent cobbles; moderately acid; clear wavy boundary.

Bt2—46 to 58 inches; reddish brown (5YR 4/4) sandy loam; few fine distinct yellowish red (5YR 5/6) and common medium distinct yellowish red (5YR 4/6) mottles; moderate medium angular blocky structure; firm; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; few faint dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; common distinct brown (7.5YR 5/3) coatings of sand primarily on vertical faces of peds; about 11 percent gravel and 2 percent cobbles; moderately acid; gradual wavy boundary.

Cd—58 to 60 inches; reddish brown (5YR 4/4) sandy loam; massive; firm; about 12 percent gravel and 2 percent cobbles; strongly acid.

The thickness of the solum ranges from 40 to 90 inches. The content of gravel ranges from 2 to 35 percent throughout the profile. The content of cobbles ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 4 inches thick. The A horizon is sandy loam or fine sandy loam. The E, Bs1, and Bs2 horizons are loam, fine sandy loam, gravelly fine sandy loam, sandy loam, or gravelly sandy loam. The E′ part of the solum commonly is loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam, but in some pedons it is fine sandy loam or gravelly fine sandy loam. The Bt part of the solum and the Cd horizon commonly are sandy loam or gravelly sandy loam, but in some pedons they are fine sandy loam or gravelly fine sandy loam.

Newot Series

The Newot series consists of well drained soils that formed dominantly in dense loamy glacial till on moraines. Permeability is moderate in the upper part of the profile, slow in the lower part of the subsoil, and very slow in the substratum. Slope ranges from 15 to 35 percent.

Typical pedon of Newot gravelly sandy loam, 15 to 35 percent slopes, approximately 500 feet east and 1,750 feet south of the northwest corner of sec. 31, T. 32 N., R. 6 E.

A—0 to 2 inches; black (10YR 2/1) gravelly sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; many fine roots; about 15 percent gravel and 2 percent cobbles; very strongly acid; abrupt wavy boundary.

E—2 to 5 inches; brown (7.5YR 4/2) gravelly sandy loam, pinkish gray (7.5YR 6/2) dry; weak medium platy structure; very friable; many fine roots; few distinct black (10YR 2/1) wormcasts; about 17 percent gravel and 2 percent cobbles; extremely acid; abrupt broken boundary.

Bs1—5 to 9 inches; dark brown (7.5YR 3/4) gravelly sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; about 22 percent gravel and 4 percent cobbles; very strongly acid; clear broken boundary.

Bs2—9 to 16 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak fine subangular blocky structure; very friable; many fine roots; about 20 percent gravel and 4 percent cobbles; strongly acid; clear wavy boundary.

E′—16 to 20 inches; brown (7.5YR 5/3) gravelly sandy loam, pink (7.5YR 5/3) dry; weak medium platy structure; very friable; common fine roots; about 14 percent gravel and 4 percent cobbles; very strongly acid; clear broken boundary.

E/B—20 to 27 inches; about 80 percent brown (7.5YR 5/3) gravelly sandy loam (E′), pink (7.5YR 7/3) dry; moderate medium platy structure; very friable; extends into and surrounds remnants of reddish brown (5YR 4/4) gravelly sandy loam (Bt); moderate fine subangular blocky structure; friable; few faint dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; common fine roots; about 20 percent gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

B/E—27 to 38 inches; about 60 percent reddish brown (5YR 4/4) gravelly sandy loam (Bt); moderate medium angular blocky structure; friable; tends to part along horizontal cleavage planes inherited from

the parent material; common faint dark reddish brown (5YR 3/4) clay films on faces of peds, many clay bridges between mineral grains, and common clay films in pores; penetrated by brown (7.5YR 5/3) gravelly sandy loam (E′), pink (7.5YR 7/3) dry; moderate medium platy structure; very friable; few fine roots; few distinct brown (7.5YR 5/3) coatings of sand in pores; about 20 percent gravel and 3 percent cobbles; moderately acid; gradual wavy boundary.

Bt—38 to 57 inches; reddish brown (5YR 4/4) gravelly sandy loam; weak coarse prismatic structure parting to weak medium subangular blocky; firm; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; few faint dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; common distinct brown (7.5YR 5/3) coatings of sand primarily on vertical faces of prisms; about 22 percent gravel and 3 percent cobbles; moderately acid; gradual wavy boundary.

Cd—57 to 60 inches; reddish brown (5YR 4/4) gravelly sandy loam; massive; firm; about 23 percent gravel and 3 percent cobbles; moderately acid.

The thickness of the solum ranges from 40 to 90 inches. The content of gravel ranges from 2 to 35 percent throughout the profile. The content of cobbles ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E, Bs1, and Bs2 horizons are loam, fine sandy loam, gravelly fine sandy loam, sandy loam, or gravelly sandy loam. The E′ part of the solum commonly is loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam, but in some pedons it is fine sandy loam or gravelly fine sandy loam. The Bt part of the solum and the Cd horizon commonly are sandy loam or gravelly sandy loam, but in some pedons they are fine sandy loam or gravelly fine sandy loam.

Ossmer Series

The Ossmer series consists of somewhat poorly drained soils that formed in silty and loamy deposits and in the underlying sand and gravel. These soils are on outwash plains, in glacial lake basins, and in outwash areas on morainic landscapes. Permeability is moderate in the upper part of the profile and rapid or very rapid in the lower part. Slope ranges from 0 to 3 percent.

Typical pedon of Ossmer silt loam, 0 to 3 percent slopes, approximately 450 feet west and 2,050 feet south of the northeast corner of sec. 6, T. 32 N., R. 8 E.

A—0 to 4 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many fine roots; about 2 percent gravel; strongly acid; abrupt wavy boundary.

E—4 to 6 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium platy structure; very friable; many fine roots; few distinct very dark gray (10YR 3/1) wormcasts; about 2 percent gravel; very strongly acid; abrupt wavy boundary.

E/B—6 to 11 inches; about 80 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; extends into and surrounds remnants of yellowish brown (10YR 5/4) silt loam (Bt); common fine prominent strong brown (7.5YR 5/8), few fine prominent yellowish red (5YR 5/6), and few fine distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to weak fine subangular blocky; friable; few prominent reddish brown (5YR 4/3) clay films on faces of peds; common fine roots; about 2 percent gravel; very strongly acid; clear wavy boundary.

B/E—11 to 26 inches; about 60 percent yellowish brown (10YR 5/4) silt loam (Bt); common fine prominent yellowish red (5YR 4/6) and strong brown (7.5YR 5/6) and common fine distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak fine subangular blocky; friable; few prominent reddish brown (5YR 4/3) clay films on faces of peds; penetrated by brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; few fine roots; few fine prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; about 2 percent gravel; very strongly acid; clear wavy boundary.

2Bt1—26 to 34 inches; dark brown (7.5YR 4/4) loam; common fine prominent yellowish red (5YR 4/6), common distinct strong brown (7.5YR 5/6), and common prominent light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to moderate fine subangular blocky; friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds; common fine prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; many prominent light brownish gray (10YR 6/2) coatings of silt and sand primarily on vertical faces of peds and in pores; about 5 percent gravel and 1 percent cobbles; very strongly acid; abrupt wavy boundary.

2Bt2—34 to 38 inches; dark brown (7.5YR 4/4) sandy loam; many medium prominent yellowish red (5YR 4/6), common fine distinct strong brown (7.5YR 5/6), and common medium prominent light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; common distinct dark reddish brown (5YR 3/4) clay bridges between mineral grains; fine prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; many prominent light brownish gray (10YR 6/2) coatings of silt and sand primarily on vertical faces of peds; about 8 percent gravel and 1 percent cobbles; strongly acid; abrupt wavy boundary.

3C—38 to 60 inches; brown (7.5YR 5/4), stratified sand and gravelly sand; few medium distinct brown (10YR 5/3) and strong brown (7.5YR 5/6) mottles; single grain; loose; an average of about 10 percent gravel; moderately acid.

The thickness of the solum ranges from 20 to 40 inches. The silty mantle is 12 to 30 inches thick. The content of gravel ranges from 0 to 5 percent in the silty mantle and from 0 to 35 percent in the loamy subsoil. The content of gravel ranges from 3 to 50 percent as a weighted average in the sandy outwash but ranges from 0 to 60 percent in individual strata. The content of cobbles ranges from 0 to 2 percent in the silty mantle and from 0 to 5 percent in the rest of the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 2 to 5 inches thick. The 2Bt horizon is loam or sandy loam or the gravelly analogs of those textures. The 3Bt horizon, if it occurs, is sand, coarse sand, loamy sand, loamy coarse sand, or the gravelly or very gravelly analogs of those textures. The strata in the 3C horizon are sand, coarse sand, or the gravelly or very gravelly analogs of those textures.

Padus Series

The Padus series consists of well drained soils that formed in loamy deposits and in the underlying sand and gravel. These soils are on outwash plains, eskers, and kames and in outwash areas on morainic landscapes. Permeability is moderate in the upper part of the profile and rapid or very rapid in the lower part. Slope ranges from 1 to 35 percent.

Typical pedon of Padus sandy loam, in an area of Pence-Padus sandy loams, 1 to 6 percent slopes, approximately 1,980 feet east and 2,110 feet north of the southwest corner of sec. 30, T. 35 N., R. 7 E.

A—0 to 3 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; moderate very fine granular structure; friable; many fine roots; few uncoated sand grains; few wood charcoal fragments; about 10 percent gravel and 2 percent cobbles; strongly acid; abrupt wavy boundary.

E—3 to 4 inches; brown (7.5YR 4/2) sandy loam, pinkish gray (7.5YR 6/2) dry; weak thin platy structure; very friable; many fine roots; few distinct very dark gray (10YR 3/1) wormcasts; about 10 percent gravel and 2 percent cobbles; very strongly acid; abrupt broken boundary.

Bs1—4 to 6 inches; dark brown (7.5YR 3/4) sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; about 12 percent gravel and 2 percent cobbles; strongly acid; abrupt wavy boundary.

Bs2—6 to 11 inches; dark brown (7.5YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; many fine roots; about 12 percent gravel and 2 percent cobbles; strongly acid; clear wavy boundary.

E/B—11 to 16 inches; about 70 percent brown (7.5YR 5/3) sandy loam (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; extends into and surrounds remnants of dark brown (7.5YR 4/4) sandy loam (Bt); moderate fine subangular blocky structure; friable; many distinct reddish brown (5YR 4/4) clay bridges between mineral grains; common fine roots; about 12 percent gravel and 2 percent cobbles; strongly acid; gradual wavy boundary.

B/E—16 to 29 inches; about 60 percent dark brown (7.5YR 4/4) sandy loam (Bt); moderate fine subangular blocky structure; friable; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; penetrated by brown (7.5YR 5/3) sandy loam (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; common fine roots; about 12 percent gravel and 2 percent cobbles; very strongly acid; abrupt irregular boundary.

2Bt—29 to 38 inches; strong brown (7.5YR 4/6) very gravelly loamy sand; weak fine subangular blocky structure; very friable; few fine roots; common prominent dark reddish brown (5YR 3/4) clay bridges between mineral grains; about 41 percent gravel and 2 percent cobbles; strongly acid; diffuse wavy boundary.

2C—38 to 60 inches; brown (7.5YR 5/4) very gravelly sand; single grain; loose; about 41 percent gravel and 2 percent cobbles; moderately acid.

The thickness of the solum ranges from 24 to 40

inches. The content of gravel ranges from 0 to 35 percent in the loamy mantle but is typically less than 15 percent. The content of gravel ranges from 3 to 50 percent as a weighted average in the sandy outwash but ranges from 0 to 60 percent in individual strata. The content of cobbles ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 4 inches thick. The E and Bs horizons are sandy loam, fine sandy loam, or loam. The E′ part of the E/B and B/E horizons is loamy sand, gravelly loamy sand, sandy loam, gravelly sandy loam, or loam. The Bt part of the solum is sandy loam, gravelly sandy loam, or loam. The 2Bt horizon is sand, gravelly sand, very gravelly sand, loamy sand, gravelly loamy sand, or very gravelly loamy sand. The 2C horizon is sand, gravelly sand, or very gravelly sand.

Padwet Series

The Padwet series consists of moderately well drained soils that formed in dominantly loamy deposits underlain by sand and gravel. These soils are on outwash plains and in outwash areas on morainic landscapes. Permeability is moderate in the upper part of the profile and rapid or very rapid in the lower part. Slope ranges from 1 to 6 percent.

Typical pedon of Padwet sandy loam, 1 to 6 percent slopes, approximately 2,520 feet south and 1,450 feet west of the northeast corner of sec. 4, T. 35 N., R. 7 E.

A—0 to 2 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak medium granular structure; friable; many fine roots; common wood charcoal fragments; high content of organic matter; about 3 percent gravel; very strongly acid; abrupt smooth boundary.

E—2 to 5 inches; brown (7.5YR 5/2) sandy loam, pinkish gray (7.5YR 7/2) dry; weak medium platy structure; very friable; many fine roots; about 3 percent gravel; strongly acid; abrupt broken boundary.

Bs1—5 to 7 inches; dark brown (7.5YR 3/4) sandy loam; weak fine subangular blocky structure; very friable; many fine roots; about 5 percent gravel; very strongly acid; abrupt wavy boundary.

Bs2—7 to 21 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; many fine roots; about 5 percent gravel; strongly acid; clear wavy boundary.

E/B—21 to 30 inches; about 80 percent brown (10YR 5/3) sandy loam (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; extends into and surrounds remnants of dark brown (7.5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds; common fine roots; about 7 percent gravel; strongly acid; gradual wavy boundary.

B/E—30 to 34 inches; about 70 percent dark brown (7.5YR 4/4) sandy loam (Bt); few fine prominent yellowish red (5YR 5/6) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds; penetrated by brown (10YR 5/3) sandy loam (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; few fine roots; about 7 percent gravel; very strongly acid; clear wavy boundary.

Bt—34 to 39 inches; dark brown (7.5YR 4/4) sandy loam; few medium prominent yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; friable; few fine roots; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds; about 8 percent gravel; very strongly acid; clear wavy boundary.

2C—39 to 60 inches; yellowish brown (10YR 5/4), stratified sand and gravelly sand; single grain; loose; about 10 percent gravel as an average; moderately acid.

The thickness of the solum ranges from 24 to 40 inches. The content of gravel ranges from 0 to 35 percent in the loamy mantle but is typically less than 15 percent. The content of gravel ranges from 3 to 50 percent in the sandy outwash as a weighted average, but it ranges from 0 to 60 percent in individual strata. The content of cobbles ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E and Bs horizons are sandy loam, fine sandy loam, or loam. The E′ part of the E/B and B/E horizons is loamy sand, gravelly loamy sand, sandy loam, gravelly sandy loam, or loam. The Bt part of the solum is sandy loam, gravelly sandy loam, or loam. The 2C horizon is sand, gravelly sand, or very gravelly sand.

Padwood Series

The Padwood series consists of moderately well drained soils in outwash-veneered areas on stream terraces and glacial lake basins. These soils formed in dominantly loamy deposits underlain by sand and gravel and stratified lacustrine deposits. Permeability is moderate in the upper part of the profile, rapid or very rapid in the upper part of the substratum, and moderately slow in the lower part of the substratum. Slope ranges from 1 to 15 percent.

Typical pedon of Padwood sandy loam, 1 to 6 percent slopes, approximately 1,290 feet west and 2,440 feet south of the northeast corner of sec. 24, T. 35 N., R. 7 E.

A—0 to 4 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many fine roots; about 3 percent gravel and 2 percent cobbles; strongly acid; abrupt wavy boundary.

E—4 to 5 inches; brown (7.5YR 5/2) sandy loam, pinkish gray (7.5YR 7/2) dry; weak thin platy structure; very friable; many fine roots; many distinct very dark gray (10YR 3/1) wormcasts; about 2 percent gravel and 2 percent cobbles; strongly acid; abrupt broken boundary.

Bs1—5 to 7 inches; dark reddish brown (5YR 3/4) sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; few prominent very dark gray (10YR 3/1) wormcasts; about 8 percent gravel and 2 percent cobbles; strongly acid; abrupt broken boundary.

Bs2—7 to 15 inches; dark brown (7.5YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; many fine roots; about 7 percent gravel and 2 percent cobbles; strongly acid; clear wavy boundary.

E/B—15 to 27 inches; about 70 percent brown (7.5YR 5/3) gravelly sandy loam (E′), pink (7.5YR 7/3) dry; weak medium platy structure; friable; extends into and surrounds remnants of dark brown (7.5YR 4/4) gravelly sandy loam (Bt); moderate fine subangular blocky structure; mostly friable, but firm in the lower 5 inches; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; common fine roots; about 14 percent gravel and 2 percent cobbles; strongly acid; abrupt wavy boundary.

2Bt—27 to 36 inches; strong brown (7.5YR 4/6) gravelly loamy sand; weak fine subangular blocky structure; very friable; few fine roots; many prominent dark reddish brown (5YR 3/4) clay bridges between mineral grains; about 21 percent gravel and 3 percent cobbles; moderately acid; abrupt wavy boundary.

2C—36 to 50 inches; light yellowish brown (10YR 6/4) sand; few medium distinct strong brown (7.5YR 5/6) mottles; single grain; loose; less than 1 percent gravel; moderately acid; abrupt wavy boundary.

3C—50 to 70 inches; primarily stratified brown (10YR 5/3) very fine sandy loam and yellowish brown (10YR 5/4) very fine sand that have a few thin interbedded strata of strong brown (7.5YR 5/6) fine sand and brown (10YR 4/3) silt loam; common fine prominent yellowish red (5YR 4/6) and common medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; parts along horizontal cleavage planes inherited from the parent material; moderately acid.

The thickness of the solum ranges from 24 to 40 inches. Depth to the 3C horizon ranges from 40 to 60 inches. The content of gravel ranges from 0 to 35 percent in the loamy mantle but is typically less than 15 percent. The content of gravel ranges from 0 to 50 percent in the sandy outwash as a weighted average, but it ranges from 0 to 60 percent in individual strata. The content of cobbles ranges from 0 to 5 percent throughout the solum and in the 2C horizon.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E and Bs horizons are sandy loam, fine sandy loam, or loam. The E′ part of the E/B horizon is loamy sand, gravelly loamy sand, sandy loam, gravelly sandy loam, or loam. The Bt part of the E/B horizon is sandy loam, gravelly sandy loam, or loam. The 2Bt horizon is loamy sand, gravelly loamy sand, or very gravelly loamy sand. The 2C horizon is sand, gravelly sand, or very gravelly sand. The strata in the 3C horizon are dominantly silt, silt loam, very fine sandy loam, loamy very fine sand, or very fine sand, but thin strata of silty clay loam, loam, fine sandy loam, loamy fine sand, fine sand, or sand are in most pedons.

Pence Series

The Pence series consists of well drained soils that formed in loamy deposits and in the underlying sand and gravel. These soils are on outwash plains, eskers, and kames and in outwash areas on morainic landscapes. Permeability is moderately rapid in the upper part of the profile and rapid or very rapid in the lower part. Slope ranges from 1 to 35 percent.

Typical pedon of Pence sandy loam, in an area of Pence-Padus sandy loams, 1 to 6 percent slopes, approximately 1,385 feet east and 1,550 feet north of the southwest corner of sec. 30, T. 35 N., R. 7 E.

A—0 to 3 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine roots; common uncoated sand grains; few wood charcoal fragments; about 10 percent gravel and 2 percent cobbles; strongly acid; abrupt wavy boundary.

E—3 to 4 inches; brown (7.5YR 4/2) sandy loam, pinkish gray (7.5YR 6/2) dry; weak fine subangular blocky structure; very friable; many fine roots; common distinct very dark gray (10YR 3/1) wormcasts; about 10 percent gravel and 2 percent

cobbles; strongly acid; abrupt broken boundary.

Bs1—4 to 8 inches; dark brown (7.5YR 3/4) sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; about 12 percent gravel and 2 percent cobbles; moderately acid; clear broken boundary.

Bs2—8 to 16 inches; dark brown (7.5YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; many fine roots; about 12 percent gravel and 2 percent cobbles; strongly acid; clear wavy boundary.

2BC1—16 to 25 inches; strong brown (7.5YR 4/6) gravelly loamy sand; weak medium subangular blocky structure; very friable; common fine roots; about 31 percent gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

2BC2—25 to 34 inches; strong brown (7.5YR 5/6) gravelly loamy sand; single grain; loose; few fine roots; about 31 percent gravel and 3 percent cobbles; moderately acid; gradual wavy boundary.

2C—34 to 60 inches; strata of yellowish brown (10YR 5/6) gravelly sand and yellowish brown (10YR 5/4) sand; single grain; loose; few fine roots; an average of about 23 percent gravel and 3 percent cobbles; moderately acid.

The thickness of the solum ranges from 12 to 36 inches. The content of gravel ranges from 0 to 35 percent in the loamy mantle. The content of gravel ranges from 15 to 35 percent in the sandy outwash as a weighted average, but it ranges from 0 to 60 percent in individual strata. The content of cobbles ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 4 inches thick. The A horizon is sandy loam or loam. The E horizon is loamy sand, sandy loam, or loam. The Bs1 horizon is loam, sandy loam, or gravelly sandy loam. The Bs2 horizon is loam, sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy sand. The 2BC horizon is sand, coarse sand, loamy sand, loamy coarse sand, or the gravelly, very gravelly, or extremely gravelly analogs of those textures. The strata in the 2C horizon are sand, coarse sand, or the gravelly, very gravelly, or extremely gravelly analogs of those textures.

Pesabic Series

The Pesabic series consists of somewhat poorly drained soils that formed in dominantly dense loamy glacial till. These soils are on moraines and drumlins. Permeability is moderate in the upper part of the profile, slow in the lower part of the subsoil, and very slow in the substratum. Slope ranges from 0 to 4 percent.

Typical pedon of Pesabic fine sandy loam, 0 to 4 percent slopes, approximately 920 feet east and 1,580 feet north of the southwest corner of sec. 31, T. 32 N., R. 6 E.

A—0 to 4 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; many fine roots; about 4 percent gravel and 2 percent cobbles; very strongly acid; abrupt wavy boundary.

E—4 to 5 inches; brown (7.5YR 5/2) fine sandy loam, pinkish gray (7.5YR 7/2) dry; weak medium platy structure; very friable; many fine roots; few prominent black (10YR 2/1) wormcasts; about 6 percent gravel and 1 percent cobbles; very strongly acid; abrupt broken boundary.

Bs1—5 to 8 inches; dark brown (7.5YR 3/4) fine sandy loam; few fine prominent yellowish red (5YR 4/6) mottles; weak very fine subangular blocky structure; very friable; many fine roots; about 8 percent gravel and 3 percent cobbles; very strongly acid; clear broken boundary.

Bs2—8 to 13 inches; dark brown (7.5YR 4/4) fine sandy loam; common fine prominent yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; very friable; many fine roots; about 9 percent gravel and 3 percent cobbles; very strongly acid; abrupt wavy boundary.

E/B—13 to 23 inches; about 80 percent brown (10YR 5/3) sandy loam (E′), very pale brown (10YR 7/3) dry; moderate medium platy structure; very friable; extends into and surrounds remnants of dark brown (7.5YR 4/4) sandy loam (Bt); few fine prominent red (2.5YR 4/6) and common medium prominent yellowish red (5YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; friable; common faint dark brown (7.5YR 3/4) clay films on faces of peds; many fine roots; about 11 percent gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

B/E—23 to 33 inches; about 70 percent reddish brown (5YR 4/4) gravelly sandy loam (Bt); common fine prominent dark red (2.5YR 3/6) and common medium distinct yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; friable; few faint dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; penetrated by brown (7.5YR 5/3) gravelly sandy loam (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; friable; common fine roots; common uncoated sand grains primarily on vertical faces of peds; about 12 percen gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

Bt1—33 to 44 inches; reddish brown (5YR 4/4) sandy

loam; few fine distinct reddish gray (5YR 5/2), few fine prominent dark red (2.5YR 3/6), and many medium distinct yellowish red (5YR 4/6) mottles; moderate fine and very fine angular blocky structure; firm; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; many faint dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; common fine prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; few distinct brown (7.5YR 5/3) coatings of silt and sand primarily on vertical faces of peds; about 10 percent gravel and 2 percent cobbles; moderately acid; clear wavy boundary.

Bt2—44 to 53 inches; reddish brown (5YR 4/4) sandy loam; few fine prominent light gray (5Y 6/1) and common medium distinct yellowish red (5YR 4/6) mottles; weak fine angular blocky structure; firm; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; few faint dark reddish brown (5YR 3/3) clay films on faces of peds, common clay bridges between mineral grains, and many clay films in pores; few distinct brown (7.5YR 5/3) coatings of silt and sand primarily on vertical faces of peds; about 9 percent gravel and 2 percent cobbles; moderately acid; gradual wavy boundary.

Cd—53 to 60 inches; reddish brown (5YR 5/3) fine sandy loam; common medium distinct yellowish red (5YR 4/6) and prominent dark red (2.5YR 3/6) and gray (5Y 5/1) mottles; massive; firm; about 11 percent gravel and 2 percent cobbles; moderately acid.

The thickness of the solum ranges from 40 to 70 inches. The content of gravel ranges from 2 to 35 percent throughout the profile. The content of cobbles ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E, Bs1, and Bs2 horizons are loam, fine sandy loam, or sandy loam. The E′ part of the solum is loamy sand, sandy loam, fine sandy loam, or the gravelly analogs of those textures. The Bt part of the solum and the Cd horizon are fine sandy loam, gravelly fine sandy loam, sandy loam, or gravelly sandy loam.

Sarona Series

The Sarona series consists of well drained soils that formed dominantly in friable, loamy glacial till. These soils are on moraines and drumlins. Permeability is moderate in the solum and moderate or moderately rapid in the substratum. Slope ranges from 6 to 35 percent.

Typical pedon of Sarona sandy loam, in an area of Sarona-Pence sandy loams, 6 to 15 percent slopes, approximately 1,490 feet west and 590 feet south of the northeast corner of sec. 35, T. 33 N., R. 7 E.

A—0 to 3 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; moderate fine and medium granular structure; very friable; many fine roots; about 6 percent gravel and 4 percent cobbles; very strongly acid; abrupt wavy boundary.

E—3 to 5 inches; brown (7.5YR 4/2) sandy loam, pinkish gray (7.5YR 6/2) dry; weak very fine subangular blocky structure; very friable; many fine roots; common distinct black (10YR 2/1) wormcasts; about 7 percent gravel and 2 percent cobbles; very strongly acid; abrupt broken boundary.

Bs1—5 to 8 inches; dark reddish brown (5YR 3/4) sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; about 11 percent gravel and 3 percent cobbles; strongly acid; abrupt broken boundary.

Bs2—8 to 12 inches; reddish brown (5YR 4/4) sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; about 11 percent gravel and 3 percent cobbles; moderately acid; gradual wavy boundary.

Bs3—12 to 18 inches; dark brown (7.5YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; many fine roots; about 11 percent gravel and 3 percent cobbles; moderately acid; gradual wavy boundary.

E′—18 to 29 inches; brown (7.5YR 5/4) sandy loam, light brown (7.5YR 6/4) dry; weak medium platy structure; very friable; many fine roots; about 11 percent gravel and 3 percent cobbles; moderately acid; clear broken boundary.

E/B—29 to 36 inches; about 70 percent brown (7.5YR 5/3) loamy sand (E′), pink (5YR 7/3) dry; weak medium platy structure; very friable; surrounds remnants of reddish brown (2.5YR 4/4) sandy loam (Bt); moderate fine subangular blocky structure; friable; many faint dark reddish brown (2.5YR 3/4) clay bridges between mineral grains; common fine roots; about 9 percent gravel and 4 percent cobbles; moderately acid; gradual wavy boundary.

B/E1—36 to 49 inches; about 70 percent reddish brown (2.5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; common faint dark reddish brown (2.5YR 3/4) clay films on faces of peds, many clay bridges between mineral grains, and many faint reddish brown (2.5YR 5/4) clay films in pores; penetrated by brown (7.5YR 5/3) sandy

loam (E′), pink (5YR 7/3) dry; weak medium platy structure; very friable; common fine roots; common uncoated sand grains on vertical faces of peds; about 13 percent gravel and 1 percent cobbles; moderately acid; gradual wavy boundary.

B/E2—49 to 58 inches; about 85 percent reddish brown (2.5YR 4/4) sandy loam (Bt); weak coarse prismatic structure parting to moderate coarse subangular blocky; friable; common faint dark reddish brown (2.5YR 3/4) clay films on faces of peds, many clay bridges between mineral grains, and many faint reddish brown (2.5YR 5/4) clay films in pores; penetrated by brown (7.5YR 5/3) sandy loam (E′), pink (5YR 7/3) dry, generally along old root channels and on faces of prisms; weak medium platy structure; very friable; few fine roots; about 9 percent gravel and 4 percent cobbles; slightly acid; diffuse wavy boundary.

B/E3—58 to 77 inches; about 90 percent reddish brown (2.5YR 4/4) sandy loam (Bt); weak coarse prismatic structure parting to weak medium subangular blocky; friable; common faint reddish brown (2.5YR 5/4) clay films in pores and common faint dark reddish brown (2.5YR 3/4) clay bridges between mineral grains; fingers of brown (7.5YR 5/3) sandy loam (E′), pink (5YR 7/3) dry, generally along old root channels and on faces of prisms; weak medium platy structure; very friable; few fine roots; about 9 percent gravel and 4 percent cobbles; slightly acid; diffuse irregular boundary.

C—77 to 99 inches; reddish brown (2.5YR 4/4) sandy loam; massive; friable; few fine roots; about 9 percent gravel and 4 percent cobbles; slightly acid.

The thickness of the solum ranges from 40 to 90 inches. The content of gravel ranges from 2 to 35 percent throughout the profile. The content of cobbles ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E and Bs horizons are sandy loam or fine sandy loam. The E′ part of the solum is loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam. The Bt part of the solum and the C horizon commonly are sandy loam or gravelly sandy loam, but in some pedons the C horizon is loamy sand or gravelly loamy sand.

Sarwet Series

The Sarwet series consists of moderately well drained, moderately permeable soils that formed in dominantly friable, loamy glacial till. These soils are on moraines and drumlins. Slope ranges from 2 to 6 percent.

Typical pedon of Sarwet sandy loam, 2 to 6 percent slopes, approximately 225 feet south and 330 feet west of the northeast corner of sec. 4, T. 35 N., R. 5 E.

A—0 to 5 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many fine roots; about 2 percent gravel and 3 percent cobbles; common uncoated sand grains; very strongly acid; abrupt wavy boundary.

E—5 to 6 inches; brown (7.5YR 5/2) loamy sand, pinkish gray (7.5YR 6/2) dry; weak thin platy structure; very friable; many fine roots; about 2 percent gravel and 3 percent cobbles; very strongly acid; abrupt broken boundary.

Bs1—6 to 11 inches; dark brown (7.5YR 3/4) sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; about 2 percent gravel and 3 percent cobbles; very strongly acid; clear broken boundary.

Bs2—11 to 22 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; many fine roots; about 6 percent gravel and 3 percent cobbles; few small discontinuous areas of brown (7.5YR 4/3) loamy sand; very strongly acid; clear wavy boundary.

E/B1—22 to 30 inches; about 70 percent pale brown (10YR 6/3) gravelly sandy loam (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; surrounds remnants of brown (7.5YR 4/4) gravelly sandy loam (Bt); few fine distinct yellowish red (5YR 4/6) and prominent dark red (2.5YR 3/6) mottles; moderate fine subangular blocky structure; friable; few prominent red (2.5YR 4/6) clay films on faces of peds; common fine roots; few prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; few small discontinuous areas of strong brown (7.5YR 4/6) loamy sand; about 12 percent gravel and 3 percent cobbles; strongly acid; abrupt wavy boundary.

E/B2—30 to 44 inches; about 60 percent brown (10YR 5/3) gravelly loamy sand and gravelly sandy loam (E′), very pale brown (10YR 7/3) dry; moderate medium platy structure; very friable; extends into and surrounds remnants of brown (7.5YR 4/3) gravelly sandy loam (Bt); few fine prominent red (2.5YR 4/6) and yellowish red (5YR 4/6) mottles; weak very fine angular blocky structure; friable; moderate medium plates inherited from the parent material; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds; few fine roots; few distinct dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; many uncoated sand grains on faces of plates; few thin broken layers of light brownish gray (2.5Y 6/2) and reddish brown

(5YR 5/3) sandy loam and loam that have many fine prominent strong brown (7.5YR 5/8) mottles; about 26 percent gravel and 5 percent cobbles; strongly acid; gradual wavy boundary.

B/E1—44 to 58 inches; about 55 percent brown (7.5YR 4/3) gravelly sandy loam (Bt); few fine prominent red (2.5YR 4/6) and yellowish red (5YR 4/6) mottles; moderate very fine angular blocky structure; friable; moderate medium plates inherited from the parent material; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds; penetrated by brown (10YR 5/3) gravelly sandy loam and gravelly loamy sand (E′), very pale brown (10YR 7/3) dry; few fine prominent red (2.5YR 4/6) and yellowish red (5YR 4/6) mottles; moderate medium platy structure; very friable; few fine roots; few distinct dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; many uncoated sand grains on faces of plates; about 14 percent gravel and 5 percent cobbles; moderately acid; gradual wavy boundary.

B/E2—58 to 71 inches; about 80 percent brown (7.5YR 4/3) gravelly sandy loam (Bt); few fine prominent dark red (2.5YR 3/6) and yellowish red (5YR 4/6) mottles; moderate very fine angular blocky structure; firm; moderate medium plates inherited from the parent material; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds; penetrated by brown (10YR 5/3) gravelly sandy loam (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; common uncoated sand grains primarily on vertical faces of peds; about 15 percent gravel and 5 percent cobbles; moderately acid; gradual wavy boundary.

Bt—71 to 84 inches; brown (7.5YR 4/3) gravelly sandy loam; few fine prominent dark red (2.5YR 3/6) and yellowish red (5YR 4/6) mottles; moderate very fine angular blocky structure; firm; moderate medium plates inherited from the parent material; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds; about 20 percent gravel and 5 percent cobbles; moderately acid; gradual wavy boundary.

C—84 to 90 inches; brown (7.5YR 4/3) very gravelly sandy loam; massive; friable; about 39 percent gravel and 10 percent cobbles; slightly acid.

The thickness of the solum ranges from 40 to 90 inches. The content of gravel ranges from 2 to 35 percent throughout the profile. The content of cobbles ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E′ and Bs horizons are sandy loam or fine sandy loam. The E′ part of the solum is loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam. The Bt part of the solum commonly is sandy loam or gravelly sandy loam. The C horizon is commonly sandy loam, gravelly sandy loam, or very gravelly sandy loam, but in some pedons it is loamy sand, gravelly loamy sand, or very gravelly loamy sand.

Sayner Series

The Sayner series consists of excessively drained soils that formed in sand and gravel deposits. These soils are on outwash plains, eskers, and kames and in outwash areas on morainic landscapes. Permeability is moderately rapid or rapid in the upper part of the profile and rapid or very rapid in the lower part. Slope ranges from 1 to 35 percent.

Typical pedon of Sayner loamy sand, in an area of Vilas-Sayner loamy sands, 1 to 6 percent slopes, approximately 2,110 feet west and 2,340 feet north of the southeast corner of sec. 24, T. 35 N., R. 7 E.

A—0 to 2 inches; very dark gray (10YR 3/1) loamy sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine roots; about 4 percent gravel; common uncoated sand grains; very strongly acid; abrupt wavy boundary.

E—2 to 5 inches; brown (7.5YR 5/2) loamy sand, pinkish gray (7.5YR 6/2) dry; weak fine subangular blocky structure; very friable; many fine roots; common distinct very dark gray (10YR 3/1) wormcasts; about 4 percent gravel; very strongly acid; abrupt broken boundary.

Bs1—5 to 9 inches; dark reddish brown (5YR 3/4) loamy sand; weak very fine subangular blocky structure; very friable; many fine roots; about 5 percent gravel; moderately acid; clear wavy boundary.

Bs2—9 to 13 inches; reddish brown (5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; many fine roots; about 5 percent gravel; strongly acid; gradual wavy boundary.

Bs3—13 to 19 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; common fine roots; about 6 percent gravel; strongly acid; clear wavy boundary.

BC—19 to 32 inches; brown (7.5YR 5/4) gravelly sand; weak coarse subangular blocky structure; very friable; few fine roots; about 15 percent gravel and 2 percent cobbles; moderately acid; clear wavy boundary.

C—32 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; about 18 percent gravel and 5 percent cobbles; moderately acid.

The thickness of the solum ranges from 12 to 36 inches. The content of gravel ranges from 15 to 35 percent in the profile as a weighted average, but it ranges from 3 to 60 percent in individual horizons or strata. The content of cobbles ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 4 inches thick. The E horizon is sand or loamy sand. The Bs horizon is loamy sand, gravelly loamy sand, sand, or gravelly sand. The BC horizon is sand or gravelly sand. The C horizon is dominantly gravelly sand, but in some pedons it has thin strata of sand or very gravelly sand.

Sconsin Series

The Sconsin series consists of moderately well drained soils that formed in silty and loamy deposits and in the underlying sand and gravel. These soils are on outwash plains, in glacial lake basins, and in outwash areas on morainic landscapes. Permeability is moderate in the upper part of the profile and rapid or very rapid in the lower part. Slope ranges from 1 to 6 percent.

Typical pedon of Sconsin silt loam, 1 to 6 percent slopes, approximately 400 feet east and 700 feet north of the southwest corner of sec. 28, T. 33 N., R. 8 E.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many fine roots; about 2 percent gravel; strongly acid; abrupt wavy boundary.

E—4 to 5 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium platy structure; very friable; many fine roots; few faint very dark grayish brown (10YR 3/2) wormcasts; about 2 percent gravel; strongly acid; abrupt broken boundary.

Bs—5 to 10 inches; dark brown (7.5YR 4/4) silt loam; weak very fine subangular blocky structure; very friable; many fine roots; about 2 percent gravel; strongly acid; clear wavy boundary.

E′—10 to 18 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; common fine roots; about 2 percent gravel; strongly acid; clear wavy boundary.

E/B—18 to 27 inches; about 60 percent brown (10YR 5/3) silt loam (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; extends into and surrounds remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); few fine prominent strong brown (7.5YR 5/6) and yellowish red (5YR 5/8) mottles; weak medium prismatic structure parting to weak fine subangular blocky; friable; few prominent reddish brown (5YR 4/3) clay films on faces of peds; few fine roots; about 3 percent gravel; very strongly acid; clear wavy boundary.

2B/E—27 to 34 inches; about 60 percent dark yellowish brown (10YR 4/4) loam (2Bt); common fine prominent dark red (2.5YR 3/6) and common medium prominent yellowish red (5YR 5/8) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; friable; tends to part along horizontal cleavage planes inherited from the parent material; few prominent dark reddish brown (5YR 3/4) clay films on faces of peds; penetrated by brown (10YR 5/3) loam (2E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; few fine roots; few fine prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; about 5 percent gravel; very strongly acid; clear wavy boundary.

2Bt—34 to 38 inches; dark yellowish brown (10YR 4/4) sandy loam; few fine prominent yellowish red (5YR 5/6) and dark red (2.5YR 3/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; common prominent dark reddish brown (5YR 3/2) clay films in pores and common prominent dark reddish brown (5YR 3/4) clay bridges between mineral grains; few faint brown (10YR 5/3) coatings of silt and sand primarily on vertical faces of peds; about 8 percent gravel; very strongly acid; abrupt wavy boundary.

3C—38 to 60 inches; strata of yellowish brown (10YR 5/4) very gravelly sand and sand; single grain; loose; an average of about 24 percent gravel; strongly acid.

The thickness of the solum ranges from 22 to 40 inches. The silty mantle is 12 to 30 inches thick. The content of gravel ranges from 0 to 5 percent in the silty mantle and from 2 to 45 percent in the loamy subsoil. The content of gravel ranges from 3 to 45 percent as a weighted average in the sandy outwash, but it ranges from 0 to 65 percent in individual strata. The content of cobbles ranges from 0 to 2 percent in the silty mantle and from 0 to 5 percent in the 2B/E, 3Bt, and 3C horizons.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 2 to 5 inches thick. The 3Bt horizon is loamy sand, gravelly loamy sand, sandy loam, gravelly sandy loam, sand, or gravelly sand. The strata in the 3C horizon are sand or coarse sand or the gravelly, very gravelly, or extremely gravelly analogs of those textures.

Vilas Series

The Vilas series consists of excessively drained, rapidly permeable soils that formed in sandy deposits. These soils are on outwash plains and in outwash areas on morainic landscapes. Slope ranges from 1 to 35 percent.

Typical pedon of Vilas loamy sand, in an area of Vilas-Sayner loamy sands, 1 to 6 percent slopes, approximately 2,040 feet west and 70 feet south of the northeast corner of sec. 15, T. 35 N., R. 6 E.

A—0 to 2 inches; very dark gray (10YR 3/1) loamy sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; many fine roots; common uncoated sand grains; about 2 percent gravel; very strongly acid; abrupt wavy boundary.

E—2 to 3 inches; brown (7.5YR 4/2) loamy sand, brown (7.5YR 5/2) dry; weak very fine subangular blocky structure; very friable; many fine roots; common distinct very dark gray (10YR 3/1) wormcasts; about 2 percent gravel; very strongly acid; abrupt broken boundary.

Bs1—3 to 6 inches; dark reddish brown (5YR 3/4) loamy sand; weak very fine subangular blocky structure; very friable; many fine roots; about 2 percent gravel; strongly acid; clear wavy boundary.

Bs2—6 to 15 inches; dark brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; many fine roots; about 3 percent gravel; moderately acid; clear wavy boundary.

Bs3—15 to 25 inches; strong brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; common fine roots; mostly about 5 percent gravel, but about 10 percent in the lower 2 inches; moderately acid; abrupt wavy boundary.

BC—25 to 30 inches; yellowish brown (10YR 5/4) sand; single grain; loose; common fine roots; about 2 percent gravel; moderately acid; gradual wavy boundary.

C—30 to 60 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; few fine roots; about 1 percent gravel; moderately acid.

The thickness of the solum ranges from 18 to 45 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 4 inches thick. The E, Bs2, and Bs3 horizons are sand or loamy sand.

Worcester Series

The Worcester series consists of somewhat poorly drained soils that formed in loamy deposits and in the underlying sand and gravel. These soils are on outwash plains and in outwash areas on morainic landscapes. Permeability is moderate in the upper part of the profile and rapid or very rapid in the lower part. Slope ranges from 0 to 3 percent.

Typical pedon of Worcester sandy loam, 0 to 3 percent slopes, approximately 580 feet east and 35 feet south of the northwest corner of sec. 18, T. 35 N., R. 5 E.

A—0 to 2 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; very friable; many fine roots; common uncoated sand grains; few wood charcoal fragments; about 2 percent gravel and 2 percent cobbles; very strongly acid; abrupt wavy boundary.

E—2 to 3 inches; brown (7.5YR 4/2) sandy loam, pinkish gray (7.5YR 6/2) dry; weak medium platy structure; very friable; many fine roots; about 2 percent gravel and 2 percent cobbles; very strongly acid; abrupt wavy boundary.

Bhs—3 to 6 inches; dark reddish brown (5YR 3/2) sandy loam; weak very fine subangular blocky structure; very friable; many fine roots; about 3 percent gravel and 2 percent cobbles; very strongly acid; clear wavy boundary.

Bs—6 to 16 inches; dark brown (7.5YR 4/4) sandy loam; few fine prominent yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; very friable; many fine roots; about 3 percent gravel and 2 percent cobbles; strongly acid; clear wavy boundary.

B/E—16 to 20 inches; about 70 percent dark brown (7.5YR 4/4) sandy loam (Bt); common fine prominent red (2.5YR 4/6) and many medium prominent yellowish red (5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; many distinct dark reddish brown (5YR 3/4) clay bridges between mineral grains; penetrated by brown (7.5YR 5/3) loamy sand (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; common fine roots; few fine prominent very dusky red (2.5YR 2/2) concretions of iron and manganese oxide; about 5 percent gravel and 2 percent cobbles; very strongly acid; clear wavy boundary.

Bt1—20 to 32 inches; dark brown (7.5YR 4/4) sandy loam; common fine distinct brown (7.5YR 5/2) and prominent yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common fine roots; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; about 8 percent gravel and 2 percent cobbles; very strongly

acid; abrupt wavy boundary.

2Bt2—32 to 39 inches; strong brown (7.5YR 4/6) gravelly loamy sand; few medium distinct reddish yellow (7.5YR 6/8) mottles; weak fine subangular blocky structure; very friable; few fine roots; common prominent dark reddish brown (5YR 3/4) clay bridges between mineral grains; about 25 percent gravel and 4 percent cobbles; strongly acid; gradual wavy boundary.

2C—39 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; few medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; about 17 percent gravel and 2 percent cobbles; strongly acid.

The thickness of the solum ranges from 24 to 40 inches. The content of gravel ranges from 0 to 35 percent in the loamy mantle but is typically less than 15 percent. The content of gravel ranges from 3 to 50 percent in the sandy outwash as a weighted average, but it ranges from 0 to 65 percent in individual strata. The content of cobbles ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E, Bhs, and Bs horizons are sandy loam, fine sandy loam, or loam. The E′ part of the B/E horizon is loamy sand, gravelly loamy sand, sandy loam, gravelly sandy loam, or loam. The Bt part of the solum is sandy loam, gravelly sandy loam, or loam. The 2Bt horizon is sand, gravelly sand, very gravelly sand, loamy sand, gravelly loamy sand, or very gravelly loamy sand. The 2C horizon is sand, coarse sand, or the gravelly, very gravelly, or extremely gravelly analogs of those textures.

Worwood Series

The Worwood series consists of somewhat poorly drained soils in outwash-veneered areas of stream terraces and glacial lake basins. These soils formed in loamy deposits underlain by sand and gravel and stratified lacustrine deposits. Permeability is moderate in the upper part of the profile, rapid or very rapid in the upper part of the substratum, and moderately slow in the lower part of the substratum. Slope ranges from 0 to 3 percent.

Typical pedon of Worwood loam, 0 to 3 percent slopes, approximately 630 feet north and 100 feet east of the southwest corner of sec. 22, T. 32 N., R. 5 E.

A—0 to 3 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many fine roots; about 12 percent gravel and 2 percent cobbles; very strongly acid; abrupt wavy boundary.

E—3 to 4 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, light brownish gray (10YR 6/2) dry; many fine prominent strong brown (7.5YR 4/6) mottles; weak medium platy structure; very friable; many fine roots; common faint very dark gray (10YR 3/1) wormcasts; about 19 percent gravel and 1 percent cobbles; very strongly acid; abrupt wavy boundary.

Bs1—4 to 7 inches; dark brown (7.5YR 3/4) gravelly sandy loam; few fine prominent yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; very friable; many fine roots; about 19 percent gravel and 1 percent cobbles; very strongly acid; clear broken boundary.

Bs2—7 to 11 inches; dark brown (7.5YR 4/4) gravelly sandy loam; common fine prominent yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; very friabie; many fine roots; about 15 percent gravel and 1 percent cobbles; very strongly acid; clear broken boundary.

E′—11 to 16 inches; brown (10YR 4/3) sandy loam, very pale brown (10YR 7/3) dry; many fine prominent yellowish red (5YR 4/6 and 5/8) and common medium faint grayish brown (10YR 5/2) mottles; weak thin platy structure; very friable; common fine roots; about 12 percent gravel and 2 percent cobbles; strongly acid; clear wavy boundary.

E/B—16 to 24 inches; about 60 percent brown (10YR 5/3) sandy loam (E′), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; extends into and surrounds remnants of dark brown (7.5YR 4/4) sandy loam (Bt); common fine prominent red (2.5YR 4/6), common medium prominent yellowish red (5YR 5/6), and many coarse prominent grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; friable; many distinct dark reddish brown (5YR 3/4) clay bridges between mineral grains; few fine roots; common fine prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; about 11 percent gravel and 2 percent cobbles; strongly acid; clear wavy boundary.

Bt—24 to 34 inches; dark brown (7.5YR 4/4) gravelly sandy loam; common coarse prominent grayish brown (10YR 5/2) and common medium prominent red (2.5YR 4/6) and yellowish red (5YR 5/6) mottles; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; friable; few fine roots; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds and many clay bridges between mineral grains; common fine prominent dark reddish brown (5YR 2/2) concretions of iron and manganese oxide; common

distinct brown (10YR 5/3) coatings of sand primarily on vertical faces of prisms; about 17 percent gravel and 2 percent cobbles; moderately acid; abrupt wavy boundary.

2C1—34 to 42 inches; brown (7.5YR 5/4) gravelly coarse sand; common medium prominent yellowish red (5YR 5/8) mottles; single grain; loose; about 17 percent gravel and 4 percent cobbles; moderately acid; abrupt wavy boundary.

3C2—42 to 60 inches; primarily stratified reddish brown (5YR 5/3) very fine sandy loam and gray (5Y 5/1) silt loam that have a few thin interbedded strata of light brown (7.5YR 6/4) very fine sand, fine sand, and sand; few medium faint reddish brown (5YR 4/4) and common medium prominent strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; massive; friable; breaks along horizontal cleavage planes inherited from the parent material; neutral.

The thickness of the solum ranges from 24 to 40 inches. Depth to the 3C horizon ranges from 40 to 60 inches. The content of gravel ranges from 0 to 35 percent in the loamy mantle but is typically less than 15 percent. The content of gravel ranges from 3 to 50 percent in the sandy outwash as a weighted average, but it ranges from 0 to 65 percent in individual strata. The content of cobbles ranges from 0 to 5 percent throughout the solum and in the 2C horizon.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is 0 to 5 inches thick. The E and Bs horizons are sandy loam, fine sandy loam, or loam. The E′ part of the solum is loamy sand, gravelly loamy sand, sandy loam, gravelly sandy loam, or loam. The Bt part of the solum is sandy loam, gravelly sandy loam, or loam. Some pedons have a 2Bt horizon. This horizon is loamy sand, gravelly loamy sand, or very gravelly loamy sand. The 2C horizon is sand, gravelly sand, or very gravelly sand. The strata in the 3C horizon are dominantly silt, silt loam, very fine sandy loam, loamy very fine sand, or very fine sand, but thin strata of silty clay loam, loam, fine sandy loam, loamy fine sand, fine sand, or sand are in many pedons.

Formation of the Soils

This section provides information about the geology and underlying material in Lincoln County and relates the factors and processes of soil formation to the soils in the county.

Geology and Underlying Material

Crystalline bedrock of Precambrian age underlies most of the glacial deposits in Lincoln County (Mudrey and others, 1982). This bedrock is a complex of folded and faulted, igneous and metamorphic rocks that are part of the Canadian Shield. They are mainly granite, gneiss, schist, metasediments, metavolcanics, and granodiorite. Joints or other cracks are in the bedrock, but these openings seldom extend more than 30 feet below the surface of the bedrock.

Several outliers of Upper Cambrian sandstone are in the area near Irma. The sandstone underlies the higher hills, at elevations above 1,650 feet. It is exposed in a roadcut about 1 mile east of Irma.

Bedrock is close to the surface in the southern part of the county, mainly in areas of association 3 on the general soil map. In this area, outcrops occur along valley slopes, especially in Pine River Township. A few bedrock outcrops are along the Wisconsin, Prairie, and New Wood Rivers (fig. 34). Bedrock also is near the surface under Nine Mile Hill and Lookout Mountain and in a few areas in Birch Township.

Glaciers moved across the survey area several times after the Ice Age began more than 1 million years ago. They transported a great amount of rocks and pulverized rock material, called glacial drift. The drift was derived from local and more distant bedrock, from material deposited by previous glaciers, and from other material transported into the area. When the ice sheets melted or stagnated, the glacial drift was deposited throughout the area in the form of till, outwash, and lacustrine deposits. The drift is several hundred feet thick in many areas but is thinner in the southern part of the county.

Glacial till in Lincoln County is of several different ages. The older till, which generally has a silty mantle, is a relatively thin surface deposit in the morainic uplands in the southern part of the county. The glacial till in this area is about 40,800 years old. Its weathering profile suggests that it is probably of early Wisconsin age (Stewart, 1973). It is known as Merrill till, and geologists refer to it as the Merrill Member of the Lincoln Formation. Generally, it is a subglacial deposit from an ice sheet that flowed from northwest to southeast.

The Merrill till is characterized by reddish colors (hue of 5YR or 2.5YR), loamy texture, and few stones. The upper part of the till is firm, and the downward movement of water is restricted. The high density of the till was probably fostered by permafrost. The fine-earth fraction (material less than 2 millimeters in size) of the unweathered till is commonly sandy loam that averages about 12 percent clay. The content of cobbles averages about 4 percent, and the content of gravel averages about 10 percent.

Wausau till lies beneath the Merrill till in some areas. Geologists refer to it as the Wausau Member of the Marathon Formation. The fine-earth fraction of the unweathered Wausau till is commonly loam that averages about 23 percent clay. The clay flows in the Wausau till are more developed than those in the younger Merrill till, which indicates considerable weathering.

Glacial till in the central and northern parts of Lincoln County is mainly from a more recent glaciation that occurred during the St. Croix-Hancock phase of the Late Wisconsin Glaciation, about 15,000 to 18,000 years ago (Nelson, 1973). During this phase, glacial ice advanced south out of the Lake Superior basin and the Wisconsin Valley Lobe stabilized over the northern two-thirds of the county. The furthest advance of the glacial ice is marked by a belt of end moraine topography that borders the Prairie and Copper River valleys. Associations 4 and 5 on the general soil map encompass the end moraine area. Because of differential melting at the edge of the glacier, the

Figure 34.—Bedrock outcrop along the Prairie River, in an area of Mequithy soils.

deposits in this area are a mixture of till, fluvial sediments, supraglacial mudflow sediments, and postglacial slope wash.

Several distinct kinds of glacial till are in the area that was covered by the Wisconsin Valley Lobe, which indicates that the lobe actually consisted of several unique ice sheets. The till in associations 3 and 5 is very similar to the Merrill till in the southern part of the county. It was deposited by an ice sheet that flowed from northwest to southeast. The many ice-walled lake basins in the end moraine area in association 5 indicate that the ice sheet stagnated for a considerable period of time. Many areas of the subglacial till in association 3 were veneered with fluvial deposits as the glacier retreated.

The glacial deposits in associations 4, 6, 7, 8, 9, 10, and 11 on the general soil map are part of the Wildcat Lake Member of the Copper Falls Formation. The Wildcat till in this general area is friable. It has more sand and less silt and clay than the firm till in the rest of the county. Two distinct kinds of Wildcat till are in this area—a brownish till is in the north-central part of the county, and a reddish till is in the northeastern part.

The brownish member of the Wildcat till commonly is gravelly sandy loam or, less commonly, gravelly loamy sand that has hue of 10YR or 7.5YR, value of 4, and chroma of 3. The fine-earth fraction of the unweathered till averages about 73 percent clay. The content of cobbles averages about 10 percent, and the content of gravel averages about 15 percent. This till was deposited by an ice sheet that flowed from northwest to southeast in the survey area. A long, prominent esker that extends from northwest to southeast along the Somo River is evidence of this movement. Generally, associations 6, 7, and 11 are associated with this ice sheet. The fluvial deposits are mostly sandy.

The reddish member of the Wildcat till (hue of 5YR or 2.5YR) commonly is loamy sand or, less commonly, sand in association 10 and in the northern part of association 4. In these areas the fine-earth fraction of the unweathered till averages about 2 percent clay. In the southern part of association 4, the fine-earth fraction is commonly sandy loam or, less commonly, loamy sand that averages about 4 percent clay. The content of cobbles averages about 3 percent, and the content of gravel averages about 10 percent. This till was deposited by an active ice sheet that generally flowed south around the eastern edge of the brown till ice sheet and built the Harrison Moraine in association 4.

The three ice sheets of the Wisconsin Valley Lobe probably occupied the northern part of the survey area simultaneously, but the north-central sublobe and the northeastern sublobe prevailed for some time after the western sublobe had retreated. The sandy fluvial deposits along the eastern terminus of the north-central sublobe indicate that it was probably the last of the sublobes to retreat from the area. It may still have been present when the Langlade Lobe of the Copper Falls Formation built the Summit Lake Moraine in the northeast corner of the county about 14,500 years ago. In Lincoln County, the Summit Lake Moraine occurs as a northwest to southeast trending ridge of mostly outwash that abuts the northeastern side of Squaw, Hilts, and Pine Lakes.

Most of the glacial outwash in Lincoln County occurs as eskers, kames, supraglacial mudflow sediments, postglacial slope wash, and outwash plains. Narrow, sinuous ridges, called eskers, and gravelly knobs, called kames, were created when meltwater deposited sand and gravel in channels and holes in the glacial ice (fig. 35). A long, prominent esker with tributary ridges trends northwest to southeast along the Somo River and terminates near Skanawan Lake in the north-central part of the county. The eskers are a valuable source of well graded sand and gravel.

The meltwater also deposited outwash in the morainic areas of the county as the glacial front fluctuated. The result is a landscape of small outwash flats intermixed with swells and hills of outwash, outwash-veneered till, and till. The poorly washed sediments within the moraines are probably mudflow material and slope wash resulting from differential melting of buried ice during the postglacial period. Meltwater from retreating ice sheets also buried or veneered the subglacial drumlins with outwash.

The outwash plains are commonly in the major river valleys where meltwater concentrated. Generally, they are stratified sand and gravel mantled with silty or loamy deposits. The silty deposits are mostly in the southern and western parts of the county. An outwash plain in the Tomahawk area, in association 7 on the general soil map, is mostly sand. The content of coarse fragments in this sandy material is generally less than 10 percent. Some of the outwash plains have kettles and meltwater flow channels. The kettles, or pits, were created by the melting of ice blocks within the outwash deposits.

Lacustrine deposits ranging from clay to sand were laid down in kettles and glacial lakes by slowly moving or ponded glacial meltwater. Some alluvial deposits are along the major drainageways in the county. This alluvium eroded from the uplands after the ice lobes melted.

During the postglacial period, many shallow lakes and waterways provided a favorable environment for aquatic plants. The organic soils in the county formed in the decomposed residue of these aquatic plants.

Factors of Soil Formation

The factors that determine the kind of soil that forms at any given point are composition of the parent material; the climate under which the soil material has accumulated and weathered; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material (Jenny, 1941). Each of these factors affects the formation of every soil, but the relative importance of each differs from place to place. One factor, for example, may dominate the formation of a soil and determine most of its properties. In general, however, the effect of each of these factors is modified by the effects of the others.

Parent Material

Parent material is the unweathered material in which a soil forms. It largely determines the chemical and mineralogical composition of the soil. Parent material in Lincoln County consists mostly of glacial till, glacial outwash, or glaciolacustrine deposits, which in many places are covered by a thin layer of silty or loamy deposits. Some of the soils formed in more recent deposits of organic material or alluvium.

Glacial till is unstratified, unsorted glacial debris made up of clay, silt, sand, gravel, stones, and boulders. Many soils in the county formed entirely or partly in glacial till. Keweenaw soils formed in areas where the till is dominantly sandy and very friable. Goodman, Goodwit, Hatley, Moodig, Sarona, and Sarwet soils and some of the Capitola soils formed in areas where the till is dominantly loamy and friable. Freeon, Magnor, Newood, Newot, and Pesabic soils and many of the Capitola soils formed in areas where

Figure 35.—A cross section of an esker in an area of Sayner soils. These long, snake-shaped ridges formed in river channels within the glacial ice.

the till is loamy and the upper part is firm and restricts the downward movement of water. Magroc and Mequithy soils formed on till landscapes where bedrock is close to the surface. Augwood and Croswood soils formed in areas where the till is covered by deep deposits of sandy outwash.

Glacial outwash is material deposited by glacial meltwater. It is dominantly sand and gravel. Antigo, Minocqua, Ossmer, and Sconsin soils formed in areas where sand and gravel are mantled with silty and loamy deposits. Padus, Padwet, Pence, and Worcester soils formed in areas where sand and gravel are mantled with loamy deposits. Au Gres, Croswell, and Vilas soils formed in areas where most of the outwash is sandy. Sayner soils formed in areas where the parent material is exclusively sand and gravel outwash.

Glaciolacustrine deposits were laid down in former glacial lake basins by ponded glacial meltwater. They commonly are interbedded or laminated. Comstock and Crystal Lake soils formed in areas where these deposits are dominantly silty. Padwood and Worwood soils formed in areas where the glaciolacustrine deposits are covered by deep deposits of glacial outwash.

Fordum soils formed in postglacial deposits of alluvium along the major drainageways. Cathro, Dawson, Loxley, Lupton, and Markey soils formed in postglacial deposits of organic material in bogs and other depressional areas.

Climate

Climate directly affects soil formation through the weathering of rocks. It also alters the parent material through the mechanical action of freezing and thawing. It indirectly affects the accumulation of organic matter by supplying energy and a suitable environment for the growth of both plant and animal organisms.

Precipitation and temperature are the chief elements

of climate responsible for soil features. These elements determine the amount of water available for percolation and the formation and decomposition of organic matter, the major processes in the formation of soils.

Percolating water from rainfall and snowmelt affects both the solution and hydration of mineral material and the organic substances. The movement of this water also controls the distribution of substances throughout the soil.

The soils in Lincoln County usually have a frozen layer in winter. This layer restricts the percolation of water. Consequently, the processes of soil formation are very slow or are suspended in winter. The physical action of frost heave also affects profile development. The high temperature in summer increases the evaporation and transpiration of moisture, thus limiting the amount of percolating water available for soil formation. Temperature also affects the growth and decomposition of organic matter. Decomposition is much slower in cooler climates than in warmer ones.

Wind indirectly affects the moisture content of soils by influencing the rate of evaporation. Also, the wind often blows away fine particles of soil and organic material, thereby eroding the surface layer. These particles are deposited elsewhere as new parent material.

Climate is modified by variations in slope aspect. The soils on slopes facing south or west are warmed and dried by the sun and wind more thoroughly than those on slopes facing north or east. The soils on the cooler, more humid slopes facing north or east generally contain more moisture and are frozen for a longer period.

Plant and Animal Life

Living organisms, such as plants, bacteria, fungi, insects, earthworms, and rodents, influence the formation of soils. Plants generally have the greatest influence on soil formation. Plant roots penetrate the soil body, thereby creating channels for percolating water. The roots excrete a number of acid substances that act on rocks and minerals and bring nutrients or mineral substances into solution. These nutrients are absorbed and translocated upward to stems and leaves. When the plants die, the translocated minerals are released to the upper soil layers. The organic acids formed from the decaying plant residue accelerate soil formation by reacting with rock and mineral constituents.

Plants indirectly affect soil formation by modifying the effects of climate. For example, some plants reduce the force of the wind, thereby influencing the evaporation rate of percolating water and the deposition of windblown parent material.

Animals burrow into the soil and mix the material of the different layers. Roots and percolating water follow the channels created by the animals. Animal life affects soil structure, helps to decompose organic matter, and carries nutrients upward in the soil profile. When the animals die, they contribute to the supply of organic material in the soil.

Human activities recently have had important effects on the soils in the county. The original condition of some soils has been altered by these activities, which include removing the native vegetation, mixing the upper layers through cultivation, and planting crops that are different from the native vegetation. Removal of the native vegetation has accelerated erosion on sloping soils. Heavy tillage and harvesting equipment has compacted the soil. Applications of lime and fertilizer have altered the pH value and fertility of soils. Some cropping practices have reduced the content of organic matter. The content of soil moisture has been altered by artificial drainage. Some of the effects of human activities, including the addition of fertilizer, pesticide, herbicide, and fungicide, may not be known for many years.

Relief

Relief influences soil formation through its effect on the amount of precipitation absorbed by the soil, on the rate of erosion, and on the translocation of material in suspension or solution from one part of the profile to another.

The steeper soils absorb less water than the less sloping soils because of a higher rate of runoff. Consequently, they are typically well drained, tend to have a thinner solum and less horizon development than the less sloping soils, and are more susceptible to erosion.

Ossmer and other somewhat poorly drained soils are mottled in the subsoil because of prolonged wetness. They commonly are less sloping than the well drained soils and are affected by a slower runoff rate, or they are lower on the landscape. They usually receive runoff from the adjacent uplands.

Minocqua and other very poorly drained soils are in the lowest positions on the landscape, where runoff is very slow or ponded. They have a grayish subsoil as a result of excessive moisture and poor aeration. The surface layer generally is darker and thicker than that of the upland soils because the moisture content is more favorable for plant growth and for the accumulation of organic matter. Organic soils form in wet depressions

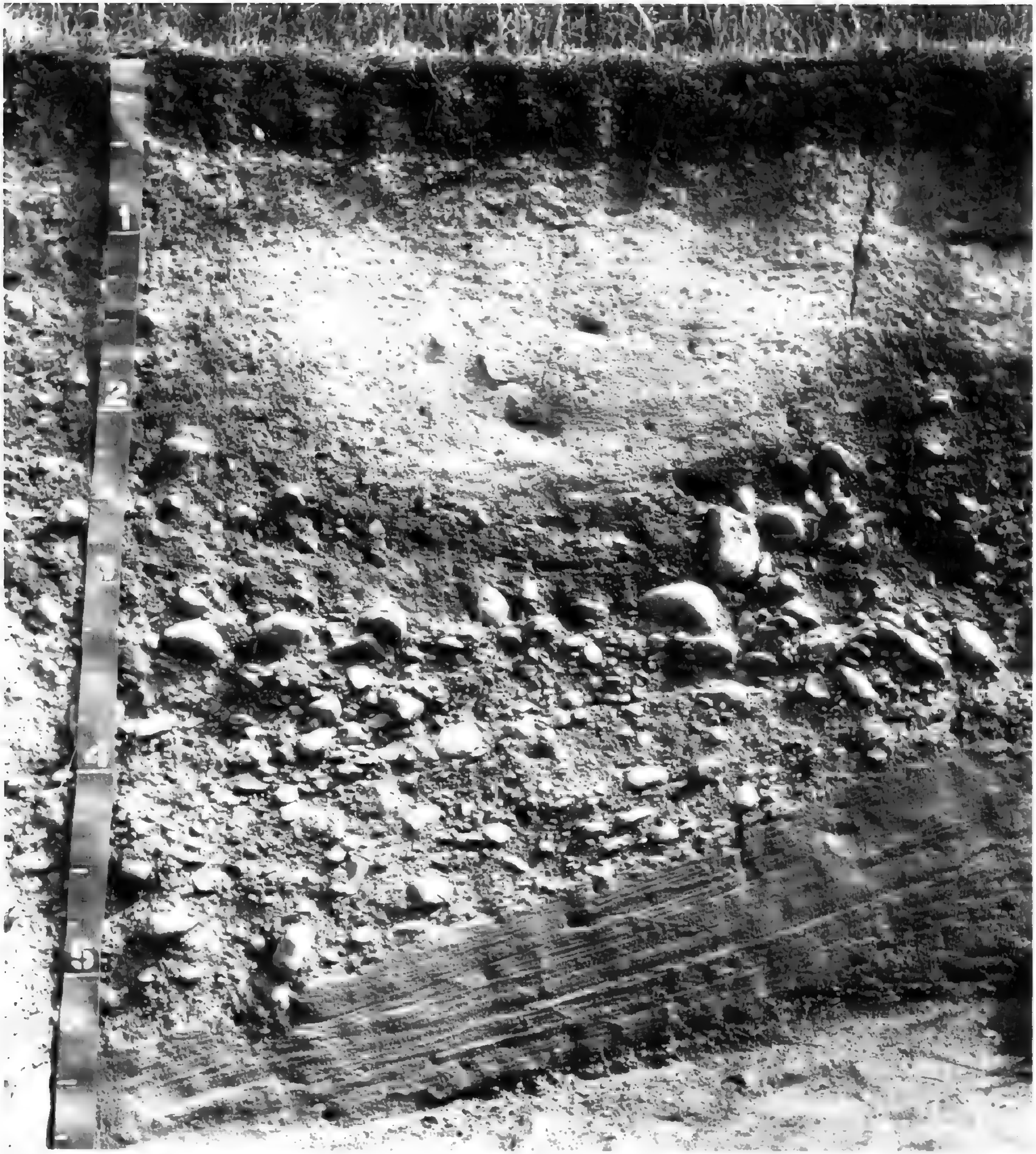

Figure 36.—A profile of an Antigo soil, which has a light colored E horizon between depths of about 12 and 30 inches. Silicate clay, iron, and aluminum have been transformed and removed from this horizon by soil-forming processes. Depth is marked in feet.

where decomposing plant residue accumulates to a depth of several feet.

Time

The effects of the soil-forming factors are modified by time. The longer the other soil-forming factors have interacted, the more highly developed or mature the soils can become. Fordum soils, for example, are immature soils in Lincoln County. These soils have few or no genetic differences between horizons because they have not been in place long enough for the soil-forming processes to take full effect. Sarona soils, on the other hand, are considered mature because they have well defined horizons. The soil-forming processes have been active in these soils for thousands of years.

Processes of Soil Formation

Physical, chemical, and biological reactions result from the interaction of the factors of soil formation. These reactions occur as soil-forming processes, such as the accumulation of organic matter in the surface layer; the transformation of soil material; and the removal, transfer, and deposition of soil components from one part of the soil profile to another (fig. 36).

The soil-forming processes are active in all soils to varying degrees. In Lincoln County the kinds of parent material and the relief have largely determined the processes that have been dominant in the formation of the soils.

Magnor soils illustrate how the soil-forming processes affect soil formation. These soils formed in silty deposits and in the underlying slightly acid, compacted sandy loam glacial till. The relief, or lay of the land, influenced the other factors of soil formation by affecting the amount of water available for percolation. A large amount of the rainfall and snowmelt infiltrated these soils because of the nearly level and gently sloping or undulating topography. This infiltration contributed to the characteristics that made the soils somewhat poorly drained. The climate and living organisms affected the accumulation of organic matter and organic acids and were conducive to the downward movement of water in the profile. In time, the changes caused by the factors and processes of soil formation accelerated.

Organic matter accumulated in the surface layer of Magnor soils as the forest litter decomposed. The surface layer became darker than it was originally. Organic acids produced during the decomposition acted on the parent material, separating minerals or altering them chemically. The iron, aluminum, and silicate clay minerals become more soluble and, along with organic matter, were subsequently moved downward in the profile by percolating water. The result is a lower base saturation status, a more acid solum, and a substantial loss of clay and other material from the leached subsurface layer. The bleached color of this layer is primarily the color of the remaining mineral separates, such as quartz.

The translocated material was deposited in the subsoil on the faces of peds, in cracks, and in openings left by plant roots, worms, and insects. As a result, the subsoil of Magnor soils has a higher content of clay than other parts of the profile. A subsoil of clay accumulation formed and later was partly destroyed. The degradation or destruction of the subsoil resulted when clay films were stripped from the faces of peds and flushed downward or horizontally by percolating water, leaving behind skeletal frameworks of uncoated silt or sand. This destruction resulted in an intermingling of the subsurface layer and the subsoil.

The downward movement of water in Magnor soils is restricted because the upper part of the glacial till is compacted. The result is a perched seasonal high water table. These soils are mottled because of the seasonally alternating reduction and oxidation of the iron compounds in the soils.

As a result of these soil-forming processes, Magnor soils have a very dark gray surface layer, a mottled and clay-depleted subsurface layer that penetrates into the subsoil, and a mottled and clay-enriched subsoil that is more acid than the substratum. At a depth of about 39 inches, they are underlain by unweathered glacial till that has changed little since it was deposited by a glacier.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock escarpment. A spot symbol used on the soil maps to indicate a narrow, elongated area where bedrock is exposed at the surface and the slope is more than about 20 percent.

Bedrock outcrop. A spot symbol used on the soil maps to indicate a small exposure of bedrock.

Board foot. A unit of measurement represented by a board 1 foot wide, 1 foot long, and 1 inch thick.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clearcutting. Removal of all the timber in a stand when trees are harvested.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles 2 millimeters to 38 centimeters (15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cord. A unit of measurement of stacked wood. A standard cord occupies 128 cubic feet with dimensions of 4 feet by 4 feet by 8 feet.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cradle-knoll. A small mound made up of soil material that temporarily clung to the roots when a tree was uprooted.

Critical-area planting. Planting stabilizing vegetation in highly erodible or critically eroding areas. The areas generally cannot be stabilized by ordinary conservation treatment and management. If the areas are left untreated, severe erosion or sediment damage may occur.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deep to water (in tables). The permanent water talbe is so deep that it adversely affects the specified use.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depression. A spot symbol used on the soil maps to indicate a small concave area where the middle of the area is generally 5 feet or more lower in elevation than the surrounding map unit.

Depth, soil. The depth to a root-restricting layer or horizon. The depth classes in Lincoln County are:

Very shallow	less than 10 inches
Shallow	10 to 20 inches
Moderately deep	20 to 40 inches
Deep	40 to 60 inches
Very deep	more than 60 inches

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed

slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Droughty (in tables). The available water capacity is so low that it adversely affects the specified use.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Dry spot. A spot symbol used on the soil maps to indicate a small area of better drained soil within a poorly drained or very poorly drained map unit.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erodes easily (in tables). A high susceptibility to water erosion affects the specified use.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Eutrophication. The aging process of lakes in which aquatic plants become abundant and water becomes deficient in oxygen. The process is usually accelerated by the enrichment of water with surface runoff containing nitrogen and phosphorus.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess humus (in tables). The content of organic matter is so high that it adversely affects the specified use.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field border. A strip of perennial vegetation established at the edge of a field.

Field windbreak. A strip of trees or shrubs established within or adjacent to a field.

Fill area. A spot symbol used on the soil maps to indicate a small area of poorly drained or very poorly drained soil where the natural soil profile is covered by at least 1 foot of fill material.

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover type. The dominant tree species in a tract of forest land.

Forest habitat type. An association of dominant tree and ground flora species in a climax plant community.

Frost action (in tables). Freezing and thawing of soil

moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Grus. The fragmental products of *in situ* granular disintegration of granite and granitic rocks.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake, drainage. Impoundments and natural lakes with both an inlet and an outlet, in which the water source is streamflow.

Lake, drained. A lake with an outlet of very little flow, in which the water source is ground water.

Lake, seepage. A lake with no inlet or outlet, in which the water source is ground water.

Lake, spring. A lake with an outlet of substantial flow, in which the water source is ground water.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loamy. A general term for the textural classes very fine sandy loam, fine sandy loam, sandy loam, coarse sandy loam, loam, clay loam, or sandy clay loam.

Low strength. The soil is not strong enough to support loads.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

No water (in tables). Depth to the permanent water table is generally more than 5 feet during wet periods.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter is described as the percent organic matter, by weight, of the material less than 2 millimeters in diameter. Classes are as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Outwash-veneered. Refers to a thin layer of glacial outwash overlying a different kind of deposit, such as glacial till.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitted outwash. An outwash area characterized by many irregular depressions, such as kettles, shallow pits, and potholes.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Poletimber. Hardwood trees ranging from 5 to 11 inches and conifers ranging from 5 to 9 inches in diameter at breast height.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandy. A general term for the textural classes loamy very fine sand, loamy fine sand, loamy sand, loamy coarse sand, very fine sand, fine sand, sand, and coarse sand.

Sapling. A tree ranging from 1 to 5 inches in diameter at breast height.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sawtimber. Hardwood trees more than 11 inches and conifers more than 9 inches in diameter at breast height.

Seedling. A tree less than 1 inch in diameter at breast height.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shelterwood cut. A method of tree harvest in which enough large trees are left to protect the younger and shorter trees from windthrow and other damage.

Short steep slope. A spot symbol used on the soil maps to indicate a narrow, elongated area where the slope is more than about 20 percent within an area of less sloping soils.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Silty. A general term for the textural classes silt, silt loam, and silty clay loam.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In Lincoln County, classes for simple slopes are as follows:

Nearly level	0 to 2 percent
Gently sloping	2 to 6 percent
Sloping	6 to 15 percent
Moderately steep to very steep	15 to 45 percent

Classes for complex slopes are as follows:

Nearly level	0 to 2 percent
Undulating	2 to 6 percent
Rolling	6 to 15 percent
Hilly to very steep	15 to 45 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil blowing (in tables). The detachment and movement of soil particles by the wind.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Soil spot. A spot symbol used on the soil maps to indicate a small island of mineral soil within an area of open water.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of

the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Strip cut. A method of tree harvest in which the timber is clearcut in strips, commonly 50 to 100 feet wide.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Succession. The progressive development of vegetation towards a stable, self-perpetuating climax plant community; replacement of one plant community by another. Shade-tolerant plant species commonly replace shade-intolerant species.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Tiers. Layers used to define the control section in the classification of organic soils. The organic material is divided into three tiers. The surface tier is the upper 12 inches, the subsurface tier is the next 24 inches, and the bottom tier is the lower 16 inches.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Vegetative row barrier. A row of tall herbaceous plants established on cropland to minimize the damage to soil and plants caused by soil blowing.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Merrill, Wisconsin)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	21.7	0.1	10.9	43	-31	0	0.95	0.30	1.47	4	8.4
February----	27.6	3.5	15.6	47	-28	0	.88	.21	1.40	3	9.1
March-------	38.0	15.5	26.8	63	-20	0	1.73	.64	2.64	5	9.8
April-------	54.6	30.8	42.7	82	10	15	2.68	1.69	3.57	6	1.6
May---------	68.6	41.5	55.1	89	23	213	3.67	2.40	4.82	8	.1
June--------	76.6	51.0	63.8	92	32	414	4.14	2.26	5.79	8	.0
July--------	81.1	55.3	68.2	93	40	564	3.92	2.51	5.19	8	.0
August------	78.5	53.3	65.9	92	35	493	4.08	2.34	5.62	8	.0
September---	68.7	44.5	56.6	87	24	214	4.02	1.86	5.87	7	.0
October-----	57.6	35.2	46.4	81	15	86	2.31	.82	3.53	5	.3
November----	40.4	22.7	31.6	64	-3	0	1.79	.71	2.68	4	5.3
December----	26.7	8.6	17.7	48	-24	0	1.24	.53	1.84	4	7.7
Yearly:											
Average---	53.3	30.2	41.8	---	---	---	---	---	---	---	---
Extreme---	---	---	---	95	-34	---	---	---	---	---	---
Total-----	---	---	---	---	---	1,999	31.41	26.73	35.74	70	42.3

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Merrill, Wisconsin)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 11	May 26	June 6
2 years in 10 later than--	May 6	May 21	June 2
5 years in 10 later than--	Apr. 28	May 10	May 24
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 26	Sept. 15	Sept. 1
2 years in 10 earlier than--	Oct. 1	Sept. 20	Sept. 7
5 years in 10 earlier than--	Oct. 12	Oct. 1	Sept. 18

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Merrill, Wisconsin)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	145	120	92
8 years in 10	153	128	101
5 years in 10	167	143	116
2 years in 10	181	158	132
1 year in 10	188	165	140

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AoB	Antigo silt loam, 1 to 6 percent slopes	5,810	1.0
AoC	Antigo silt loam, 6 to 15 percent slopes	4,080	0.7
AuA	Au Gres loamy sand, 0 to 3 percent slopes	3,100	0.5
AxA	Augwood loamy sand, 0 to 3 percent slopes	3,350	0.6
CoA	Comstock silt loam, 0 to 3 percent slopes	2,830	0.5
CpA	Comstock-Magnor silt loams, 0 to 3 percent slopes	3,030	0.5
CrB	Croswell loamy sand, 1 to 6 percent slopes	8,390	1.4
CsB	Croswood loamy sand, 1 to 6 percent slopes	7,240	1.2
CyB	Crystal Lake silt loam, 1 to 6 percent slopes	2,160	0.4
CyC	Crystal Lake silt loam, 6 to 15 percent slopes	590	0.1
Fh	Fordum loam, 0 to 2 percent slopes	5,490	0.9
FoB	Freeon silt loam, 2 to 6 percent slopes	18,800	3.2
FoC	Freeon silt loam, 6 to 15 percent slopes	7,030	1.2
FsB	Freeon-Sconsin silt loams, 2 to 6 percent slopes	7,230	1.2
GoC	Goodman silt loam, 6 to 15 percent slopes	4,150	0.7
GwB	Goodwit silt loam, 2 to 6 percent slopes	1,690	0.3
HyB	Hatley silt loam, 0 to 4 percent slopes	1,270	0.2
KwC	Keweenaw sandy loam, 6 to 15 percent slopes	4,640	0.8
KwD	Keweenaw sandy loam, 15 to 35 percent slopes	9,690	1.7
Lo	Loxley and Dawson peats, 0 to 1 percent slopes	16,430	2.8
Lu	Lupton, Cathro, and Markey mucks, 0 to 1 percent slopes	57,396	9.9
MaB	Magnor silt loam, 0 to 4 percent slopes	110,140	19.0
MgB	Magnor-Ossmer silt loams, 0 to 4 percent slopes	18,090	3.1
MkB	Magroc silt loam, 0 to 4 percent slopes	1,550	0.3
MoB	Mequithy silt loam, 2 to 6 percent slopes	3,200	0.6
MoC	Mequithy silt loam, 6 to 15 percent slopes	3,210	0.6
Ms	Minocqua and Capitola mucks, 0 to 2 percent slopes	41,400	7.1
MxB	Moodig sandy loam, 0 to 4 percent slopes	10,770	1.9
NeC	Newood sandy loam, 6 to 15 percent slopes	11,310	2.0
NoB	Newood fine sandy loam, 2 to 6 percent slopes	6,680	1.1
NpC	Newood-Pence sandy loams, 6 to 15 percent slopes	4,810	0.8
NwD	Newot gravelly sandy loam, 15 to 35 percent slopes	2,710	0.5
OsA	Ossmer silt loam, 0 to 3 percent slopes	25,900	4.5
PaB	Padwet sandy loam, 1 to 6 percent slopes	7,650	1.3
PbB	Padwood sandy loam, 1 to 6 percent slopes	3,610	0.6
PbC	Padwood sandy loam, 6 to 15 percent slopes	820	0.1
PcC	Pence-Antigo complex, 6 to 15 percent slopes	1,780	0.3
PeB	Pence-Padus sandy loams, 1 to 6 percent slopes	12,940	2.2
PeC	Pence-Padus sandy loams, 6 to 15 percent slopes	13,410	2.3
PeD	Pence-Padus sandy loams, 15 to 35 percent slopes	9,000	1.6
PsB	Pesabic fine sandy loam, 0 to 4 percent slopes	6,970	1.2
Pt	Pits, gravel	810	0.1
SaC	Sarona-Pence sandy loams, 6 to 15 percent slopes	18,060	3.1
SaD	Sarona-Pence sandy loams, 15 to 35 percent slopes	11,620	2.0
SbB	Sarwet sandy loam, 2 to 6 percent slopes	13,830	2.4
ScB	Sconsin silt loam, 1 to 6 percent slopes	15,630	2.7
VsB	Vilas-Sayner loamy sands, 1 to 6 percent slopes	14,050	2.4
VsC	Vilas-Sayner loamy sands, 6 to 15 percent slopes	11,650	2.0
VsD	Vilas-Sayner loamy sands, 15 to 35 percent slopes	5,700	1.0
WoA	Worcester sandy loam, 0 to 3 percent slopes	3,780	0.7
WsA	Worwood loam, 0 to 3 percent slopes	1,660	0.3
	Water	14,125	2.4
	Total	581,261	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
AoB	Antigo silt loam, 1 to 6 percent slopes
CoA	Comstock silt loam, 0 to 3 percent slopes (where drained)
CpA	Comstock-Magnor silt loams, 0 to 3 percent slopes (where drained)
CyB	Crystal Lake silt loam, 1 to 6 percent slopes
FoB	Freeon silt loam, 2 to 6 percent slopes
FsB	Freeon-Sconsin silt loams, 2 to 6 percent slopes
GwB	Goodwit silt loam, 2 to 6 percent slopes
HyB	Hatley silt loam, 0 to 4 percent slopes (where drained)
MaB	Magnor silt loam, 0 to 4 percent slopes (where drained)
MgB	Magnor-Ossmer silt loams, 0 to 4 percent slopes (where drained)
MkB	Magroc silt loam, 0 to 4 percent slopes (where drained)
MoB	Mequithy silt loam, 2 to 6 percent slopes
Ms	Minocqua and Capitola mucks, 0 to 2 percent slopes (where drained)
MxB	Moodig sandy loam, 0 to 4 percent slopes (where drained)
NoB	Newood fine sandy loam, 2 to 6 percent slopes
OsA	Ossmer silt loam, 0 to 3 percent slopes (where drained)
PaB	Padwet sandy loam, 1 to 6 percent slopes
PbB	Padwood sandy loam, 1 to 6 percent slopes
PsB	Pesabic fine sandy loam, 0 to 4 percent slopes (where drained)
SbB	Sarwet sandy loam, 2 to 6 percent slopes
ScB	Sconsin silt loam, 1 to 6 percent slopes
WoA	Worcester sandy loam, 0 to 3 percent slopes (where drained)
WsA	Worwood loam, 0 to 3 percent slopes (where drained)

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Potential productivity: Common trees	Site index	Volume*	Trees to plant
AoB, AoC: Antigo	3L	Slight	Slight	Slight	Severe	Sugar maple	66	41	Eastern white pine, red pine, white spruce.
						American basswood	69	64	
						Black cherry	---	---	
						Yellow birch	71	44	
						White ash	74	72	
AuA: Au Gres	6W	Slight	Moderate	Severe	Severe	Red pine	56	90	White spruce, red pine, eastern white pine, red maple.
						Quaking aspen	70	81	
						Balsam fir	---	---	
						Paper birch	---	---	
						Yellow birch	---	---	
						Red maple	65	40	
						Eastern hemlock	---	---	
						Eastern white pine	---	---	
						Northern red oak	---	---	
						Jack pine	51	69	
AxA: Augwood	7W	Slight	Moderate	Severe	Severe	Red pine	58	96	Red pine, eastern white pine, red maple, white spruce.
						Red maple	---	---	
						Paper birch	---	---	
						Quaking aspen	---	---	
						Balsam fir	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						Eastern white pine	---	---	
						Jack pine	---	---	
						Northern red oak	---	---	
CoA: Comstock	3W	Slight	Slight	Moderate	Severe	Red maple	61	38	Eastern white pine, white spruce, red pine, red maple, white ash.
						Sugar maple	65	40	
						Balsam fir	---	---	
						Quaking aspen	---	---	
						White ash	---	---	
						Paper birch	---	---	
						Yellow birch	---	---	
						American hornbeam	---	---	
CpA:									
Comstock	3W	Slight	Slight	Moderate	Severe	Red maple	61	38	Eastern white pine, white spruce, red pine, red maple, white ash.
						Sugar maple	65	40	
						Balsam fir	---	---	
						Quaking aspen	---	---	
						White ash	---	---	
						Paper birch	---	---	
						Yellow birch	---	---	
						American hornbeam	---	---	
Magnor	3W	Slight	Slight	Moderate	Severe	Red maple	65	40	Eastern white pine, white spruce, red pine, red maple, white ash.
						Northern red oak	67	38	
						Sugar maple	61	61	
						American basswood	67	61	
						Yellow birch	---	---	
						White ash	68	63	
						Quaking aspen	---	---	
						American hornbeam	---	---	
						Paper birch	---	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume*	Trees to plant
CrB------------- Croswell	6A	Slight	Moderate	Slight	Moderate	Red pine-----------	56	78	Red pine, eastern white pine, Norway spruce, jack pine.
						Quaking aspen-------	68	78	
						Jack pine-----------	53	73	
						Northern red oak----	---	---	
						Eastern white pine--	---	---	
						Red maple-----------	---	---	
						Paper birch---------	54	55	
						Balsam fir----------	---	---	
CsB------------- Croswood	7A	Slight	Moderate	Slight	Moderate	Red pine------------	60	101	Red pine, eastern white pine, jack pine, Norway spruce.
						Eastern white pine--	---	---	
						Red maple-----------	---	---	
						Northern red oak----	---	---	
						Paper birch---------	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
CyB, CyC-------- Crystal Lake	3L	Slight	Slight	Slight	Severe	Sugar maple---------	61	38	Eastern white pine, red pine, white spruce.
						American basswood---	69	64	
						Yellow birch--------	---	---	
						Black cherry--------	---	---	
						White ash-----------	71	67	
Fh-------------- Fordum	2W	Slight	Severe	Severe	Severe	Silver maple--------	80	34	Red maple, white ash, black spruce, white spruce.
						Red maple-----------	---	---	
						Black ash-----------	---	---	
						Eastern hemlock-----	---	---	
						American elm--------	---	---	
						Quaking aspen-------	---	---	
						Balsam fir----------	---	---	
FoB, FoC-------- Freeon	3D	Slight	Slight	Slight	Severe	Sugar maple---------	62	39	Red pine, eastern white pine, white spruce.
						Northern red oak----	63	56	
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hophornbeam-	---	---	
						White ash-----------	---	---	
FsB:									
Freeon---------	3D	Slight	Slight	Slight	Severe	Sugar maple---------	62	39	Red pine, eastern white pine, white spruce.
						Northern red oak----	63	56	
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Eastern hophornbeam-	---	---	
						White ash-----------	---	---	
Sconsin--------	3L	Slight	Slight	Slight	Severe	Sugar maple---------	62	38	Eastern white pine, red pine, white spruce.
						American basswood---	---	---	
						Northern red oak----	---	---	
						Eastern white pine--	---	---	
						Yellow birch--------	---	---	
						White ash-----------	---	---	
						Bigtooth aspen------	---	---	
						Quaking aspen-------	---	---	
						Black cherry--------	---	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
GoC: Goodman	3L	Slight	Slight	Slight	Severe	Sugar maple	69	42	Eastern white pine, red pine, white spruce.
						Yellow birch	---	---	
						American basswood	68	63	
						White ash	---	---	
						Black cherry	---	---	
						Eastern hophornbeam	---	---	
GwB: Goodwit	3L	Slight	Slight	Slight	Severe	Sugar maple	69	42	Eastern white pine, red pine, white spruce.
						Yellow birch	---	---	
						American basswood	68	63	
						Bigtooth aspen	---	---	
						Quaking aspen	---	---	
						Paper birch	---	---	
						White ash	---	---	
						Black cherry	---	---	
						Eastern hophornbeam	---	---	
HyB: Hatley	3W	Slight	Slight	Moderate	Severe	Red maple	66	41	Red pine, eastern white pine, white spruce, red maple, white ash.
						Balsam fir	57	111	
						American basswood	---	---	
						White ash	---	---	
						Quaking aspen	---	---	
						Yellow birch	---	---	
						Sugar maple	---	---	
KwC: Keweenaw	3A	Slight	Slight	Slight	Moderate	Sugar maple	59	37	Eastern white pine, red pine, Norway spruce.
						Northern red oak	64	57	
						Paper birch	60	65	
						Red maple	---	---	
						Quaking aspen	---	---	
						American basswood	---	---	
						White ash	---	---	
KwD: Keweenaw	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	59	37	Eastern white pine, red pine, Norway spruce.
						Northern red oak	64	57	
						Paper birch	60	65	
						Red maple	---	---	
						Quaking aspen	---	---	
						American basswood	---	---	
						White ash	---	---	
Lo: Loxley	2W	Slight	Severe	Severe	Severe	Black spruce	15	23	---
						Tamarack	---	---	
Dawson	2W	Slight	Severe	Severe	Severe	Black spruce	15	23	---
						Tamarack	---	---	
Lu: Lupton	7W	Slight	Severe	Severe	Severe	Balsam fir	53	102	---
						Black spruce	20	29	
						Northern whitecedar	---	---	
						American elm	---	---	
						Tamarack	---	---	
						Red maple	---	---	
						Quaking aspen	---	---	
						Eastern hemlock	---	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume*	Trees to plant
Lu:									
Cathro	7W	Slight	Severe	Severe	Severe	Balsam fir	53	102	---
						Northern whitecedar	33	48	
						Tamarack	---	---	
						Red maple	---	---	
						Black spruce	---	---	
						Eastern hemlock	---	---	
						Quaking aspen	---	---	
						American elm	---	---	
Markey	7W	Slight	Severe	Severe	Severe	Balsam fir	52	100	---
						Northern whitecedar	41	61	
						Tamarack	---	---	
						Black spruce	---	---	
						Red maple	---	---	
						Eastern hemlock	---	---	
						Quaking aspen	---	---	
						American elm	---	---	
MaB Magnor	3W	Slight	Slight	Moderate	Severe	Red maple	65	40	Eastern white pine, white spruce, red pine, red maple, white ash.
						Northern red oak	67	61	
						Sugar maple	61	38	
						American basswood	67	61	
						Yellow birch	---	---	
						White ash	68	63	
						Quaking aspen	---	---	
						American hornbeam	---	---	
						Balsam fir	---	---	
MgB:									
Magnor	3W	Slight	Slight	Moderate	Severe	Red maple	65	40	Eastern white pine, white spruce, red pine, red maple, white ash.
						Northern red oak	67	61	
						Sugar maple	61	38	
						American basswood	67	61	
						Yellow birch	---	---	
						White ash	68	63	
						Quaking aspen	---	---	
						American hornbeam	---	---	
						Balsam fir	---	---	
						Paper birch	---	---	
Ossmer	3W	Slight	Slight	Moderate	Severe	Red maple	66	41	Red maple, white ash, white spruce, eastern white pine, red pine.
						Quaking aspen	78	91	
						Balsam fir	---	---	
						Paper birch	---	---	
						Yellow birch	---	---	
						Sugar maple	---	---	
						White ash	---	---	
						American hornbeam	---	---	
MkB Magroc	3W	Slight	Slight	Moderate	Severe	Red maple	65	40	Red maple, white ash, white spruce, eastern white pine, red pine.
						Sugar maple	---	---	
						White ash	---	---	
						American basswood	---	---	
						Yellow birch	---	---	
						Northern red oak	---	---	
						Balsam fir	---	---	
						American hornbeam	---	---	
						Quaking aspen	---	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
MoB, MoC--------Mequithy	3L	Slight	Slight	Slight	Moderate	Sugar maple----------	59	37	Eastern white pine, red pine, white spruce.
						Northern red oak----	---	---	
						Eastern hophornbeam-	---	---	
						Paper birch----------	---	---	
						Red maple-----------	---	---	
						Yellow birch---------	---	---	
						Eastern white pine--	---	---	
						American basswood---	---	---	
						White ash-----------	---	---	
						Black cherry---------	---	---	
Ms: Minocqua-------	7W	Slight	Severe	Severe	Severe	Balsam fir----------	54	105	Red maple, white ash, white spruce, black spruce.
						Red maple-----------	55	35	
						Black spruce--------	---	---	
						Black ash-----------	---	---	
						Tamarack------------	55	50	
						Northern whitecedar-	---	---	
						Quaking aspen-------	---	---	
						American elm--------	---	---	
						Eastern hemlock-----	---	---	
Capitola-------	7W	Slight	Severe	Severe	Severe	Balsam fir----------	54	105	Red maple, white ash, black spruce, white spruce.
						Red maple-----------	56	36	
						Black ash-----------	48	31	
						Quaking aspen-------	---	---	
						Northern whitecedar-	---	---	
						Tamarack------------	---	---	
						American elm--------	---	---	
						Eastern hemlock-----	---	---	
						Black spruce--------	---	---	
MxB-------------Moodig	3W	Slight	Slight	Moderate	Severe	Red maple-----------	60	38	Red maple, white ash, white spruce, eastern white pine, red pine.
						Yellow birch--------	---	---	
						Sugar maple---------	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						Eastern hemlock-----	---	---	
						Paper birch---------	---	---	
NeC, NoB--------Newood	3D	Slight	Slight	Slight	Moderate	Sugar maple---------	59	37	Red pine, eastern white pine, white spruce.
						Red maple-----------	---	---	
						Northern red oak----	---	---	
						Eastern hophornbeam-	---	---	
						Paper birch---------	---	---	
						Bigtooth aspen------	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						White ash-----------	---	---	
NpC: Newood---------	3D	Slight	Slight	Slight	Moderate	Sugar maple---------	59	37	Red pine, eastern white pine, white spruce.
						Red maple-----------	---	---	
						Northern red oak----	---	---	
						Eastern hophornbeam-	---	---	
						Paper birch---------	---	---	
						Bigtooth aspen------	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						White ash-----------	---	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume*	Trees to plant
NpC:									
Pence	3A	Slight	Slight	Slight	Slight	Sugar maple	59	37	Red pine, eastern white pine, jack pine, Norway spruce.
						Eastern white pine	57	112	
						Red maple	---	---	
						Northern red oak	---	---	
						Paper birch	---	---	
NwD Newot	3R	Moderate	Moderate	Slight	Moderate	Sugar maple	59	37	Red pine, eastern white pine, white spruce.
						Red maple	---	---	
						Northern red oak	---	---	
						Eastern hophornbeam	---	---	
						Paper birch	---	---	
						Bigtooth aspen	---	---	
						White ash	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
OsA Ossmer	3W	Slight	Slight	Moderate	Severe	Red maple	66	41	Red maple, white ash, white spruce, eastern white pine, red pine.
						Quaking aspen	78	91	
						Balsam fir	---	---	
						Paper birch	---	---	
						Yellow birch	---	---	
						Sugar maple	---	---	
						White ash	---	---	
						American hornbeam	---	---	
PaB Padwet	3L	Slight	Slight	Slight	Moderate	Sugar maple	67	41	Red pine, eastern white pine, white spruce.
						Northern red oak	70	66	
						American basswood	---	---	
						White ash	---	---	
						Red maple	---	---	
						Eastern hemlock	---	---	
PbB, PbC Padwood	3L	Slight	Slight	Slight	Moderate	Sugar maple	67	41	White spruce, eastern white pine, red pine.
						American basswood	---	---	
						Northern red oak	---	---	
						Red maple	---	---	
						White ash	---	---	
						Eastern hemlock	---	---	
PcC:									
Pence	3A	Slight	Slight	Slight	Slight	Sugar maple	59	37	Red pine, eastern white pine, Norway spruce.
						Eastern white pine	57	112	
						Northern red oak	---	---	
						Red maple	---	---	
						Paper birch	---	---	
Antigo	3L	Slight	Slight	Slight	Severe	Sugar maple	66	41	Eastern white pine, red pine, white spruce.
						American basswood	69	64	
						Black cherry	---	---	
						Yellow birch	71	44	
						White ash	74	72	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume*	Trees to plant
PeB, PeC:									
Pence----------	3A	Slight	Slight	Slight	Slight	Sugar maple---------	59	37	Red pine, eastern white pine, Norway spruce.
						Eastern white pine--	57	112	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
Padus----------	3L	Slight	Slight	Slight	Moderate	Sugar maple---------	67	41	Red pine, eastern white pine, white spruce.
						Northern red oak----	70	66	
						White ash-----------	---	---	
						American basswood---	---	---	
						Red pine------------	---	---	
						Red maple-----------	---	---	
						Eastern hemlock-----	---	---	
PeD:									
Pence----------	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	59	37	Red pine, eastern white pine, Norway spruce.
						Eastern white pine--	57	112	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
Padus----------	3R	Moderate	Moderate	Slight	Moderate	Sugar maple---------	67	41	Red pine, eastern white pine, white spruce.
						Northern red oak----	70	66	
						White ash-----------	---	---	
						American basswood---	---	---	
						Red maple-----------	---	---	
						Eastern hemlock-----	---	---	
PsB------------- Pesabic	3W	Slight	Moderate	Severe	Severe	Red maple-----------	59	37	Red maple, white ash, white spruce, eastern white pine, red pine.
						Sugar maple---------	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Northern red oak----	---	---	
						Paper birch---------	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
SaC:									
Sarona---------	3L	Slight	Slight	Slight	Moderate	Sugar maple---------	64	40	Red pine, eastern white pine, white spruce.
						Northern red oak----	72	69	
						American basswood---	70	66	
						White ash-----------	75	73	
						Eastern hemlock-----	---	---	
Pence----------	3A	Slight	Slight	Slight	Slight	Sugar maple---------	59	37	Red pine, eastern white pine, Norway spruce.
						Eastern white pine--	57	112	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Paper birch---------	---	---	
SaD:									
Sarona---------	3R	Moderate	Moderate	Slight	Moderate	Sugar maple---------	64	40	Red pine, eastern white pine, white spruce.
						Northern red oak----	72	69	
						American basswood---	70	66	
						White ash-----------	75	73	
						Eastern hemlock-----	---	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
SaD:									
Pence	3R	Moderate	Moderate	Slight	Slight	Sugar maple	59	37	Red pine, eastern white pine, Norway spruce.
						Eastern white pine	57	112	
						Northern red oak	---	---	
						Red maple	---	---	
						Paper birch	---	---	
SbB Sarwet	3L	Slight	Slight	Slight	Severe	Sugar maple	64	40	Red pine, eastern white pine, white spruce.
						Northern red oak	72	69	
						American basswood	70	66	
						White ash	75	73	
						Eastern hemlock	---	---	
ScB Sconsin	3L	Slight	Slight	Slight	Severe	Sugar maple	62	38	Eastern white pine, red pine, white spruce.
						American basswood	---	---	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						Yellow birch	---	---	
						White ash	---	---	
						Bigtooth aspen	---	---	
						Quaking aspen	---	---	
						Black cherry	---	---	
VsB, VsC:									
Vilas	6A	Slight	Moderate	Slight	Slight	Red pine	57	93	Red pine, jack pine, eastern white pine, Norway spruce.
						Jack pine	65	94	
						Eastern white pine	56	109	
						Balsam fir	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
						Red maple	---	---	
						Paper birch	---	---	
Sayner	7A	Slight	Moderate	Slight	Slight	Red pine	59	99	Red pine, jack pine, eastern white pine, Norway spruce.
						Jack pine	---	---	
						Eastern white pine	57	112	
						Northern red oak	---	---	
						Quaking aspen	---	---	
						Paper birch	---	---	
						Red maple	---	---	
						Balsam fir	---	---	
VsD:									
Vilas	6R	Moderate	Moderate	Slight	Slight	Red pine	57	93	Red pine, jack pine, eastern white pine, Norway spruce.
						Jack pine	65	94	
						Eastern white pine	56	109	
						Balsam fir	---	---	
						Quaking aspen	---	---	
						Northern red oak	---	---	
						Red maple	---	---	
						Paper birch	---	---	
Sayner	7R	Moderate	Moderate	Slight	Slight	Red pine	59	99	Red pine, jack pine, eastern white pine, Norway spruce.
						Jack pine	---	---	
						Eastern white pine	57	112	
						Northern red oak	---	---	
						Quaking aspen	---	---	
						Paper birch	---	---	
						Red maple	---	---	
						Balsam fir	---	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
WoA------------- Worcester	2W	Slight	Slight	Moderate	Severe	Red maple-----------	55	35	Red maple, white spruce, eastern white pine, white ash, red pine.
						Sugar maple---------	---	---	
						Yellow birch--------	---	---	
						Balsam fir----------	---	---	
						White spruce--------	---	---	
						Paper birch---------	---	---	
						Quaking aspen-------	---	---	
						Eastern hemlock-----	---	---	
WsA------------- Worwood	3W	Slight	Moderate	Severe	Severe	Red maple-----------	60	38	Red maple, white spruce, white ash, eastern white pine, red pine.
						Sugar maple---------	---	---	
						Paper birch---------	---	---	
						Balsam fir----------	---	---	
						Yellow birch--------	---	---	
						Eastern hemlock-----	---	---	
						Quaking aspen-------	---	---	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

TABLE 7.--WOODLAND EQUIPMENT USE

(Only the soils suitable for production of commercial trees are listed. Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Ratings for the most limiting season: Logging areas and skid trails	Log landings	Haul roads	Site preparation and planting	Preferred operating season(s)
AoB, AoC: Antigo	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
AuA: Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.
AxA: Augwood	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.
CoA: Comstock	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
CpA:					
Comstock	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
Magnor	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
CrB: Croswell	Slight	Slight	Slight	Slight	Year round.
CsB: Croswood	Slight	Slight	Slight	Slight	Year round.
CyB, CyC: Crystal Lake	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
Fh: Fordum	Severe: wetness, low strength.	Severe: wetness, flooding, low strength.	Severe: wetness, flooding, low strength.	Severe: wetness, low strength.	Winter.
FoB: Freeon	Slight	Slight	Slight	Slight	Year round.
FoC: Freeon	Slight	Moderate: slope.	Slight	Slight	Year round.
FsB:					
Freeon	Slight	Slight	Slight	Slight	Year round.
Sconsin	Slight	Slight	Slight	Slight	Year round.
GoC: Goodman	Slight	Moderate: slope.	Slight	Slight	Year round.
GwB: Goodwit	Slight	Slight	Slight	Slight	Year round.

TABLE 7.--WOODLAND EQUIPMENT USE--Continued

Soil name and map symbol	Logging areas and skid trails	Log landings	Haul roads	Site preparation and planting	Preferred operating season(s)
	Ratings for the most limiting season				
HyB: Hatley	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
KwC: Keweenaw	Slight	Moderate: slope.	Slight	Slight	Year round.
KwD: Keweenaw	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
Lo:					
Loxley	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
Dawson	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
Lu:					
Lupton	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
Cathro	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
Markey	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
MaB: Magnor	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
MgB:					
Magnor	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
Ossmer	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.
MkB: Magroc	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
MoB: Mequithy	Slight	Moderate: depth to rock.	Moderate: depth to rock.	Slight	Year round.
MoC: Mequithy	Slight	Moderate: slope, depth to rock.	Moderate: depth to rock.	Slight	Year round.
Ms:					
Minocqua	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.

TABLE 7.--WOODLAND EQUIPMENT USE--Continued

Soil name and map symbol	Ratings for the most limiting season: Logging areas and skid trails	Log landings	Haul roads	Site preparation and planting	Preferred operating season(s)
Ms:					
Capitola	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
MxB Moodig	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
NeC Newood	Slight	Moderate: slope.	Slight	Slight	Year round.
NoB Newood	Slight	Slight	Slight	Slight	Year round.
NpC:					
Newood	Slight	Moderate: slope.	Slight	Slight	Year round.
Pence	Slight	Moderate: slope.	Slight	Slight	Year round.
NwD Newot	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
OsA Ossmer	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.
PaB Padwet	Slight	Slight	Slight	Slight	Year round.
PbB Padwood	Slight	Slight	Slight	Slight	Year round.
PbC Padwood	Slight	Moderate: slope.	Slight	Slight	Year round.
PcC:					
Pence	Slight	Moderate: slope.	Slight	Slight	Year round.
Antigo	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
PeB:					
Pence	Slight	Slight	Slight	Slight	Year round.
Padus	Slight	Slight	Slight	Slight	Year round.
PeC:					
Pence	Slight	Moderate: slope.	Slight	Slight	Year round.
Padus	Slight	Moderate: slope.	Slight	Slight	Year round.
PeD:					
Pence	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.

TABLE 7.--WOODLAND EQUIPMENT USE--Continued

Soil name and map symbol	Ratings for the most limiting season: Logging areas and skid trails	Log landings	Haul roads	Site preparation and planting	Preferred operating season(s)
PeD:					
Padus	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
PsB Pesabic	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
SaC:					
Sarona	Slight	Moderate: slope.	Slight	Slight	Year round.
Pence	Slight	Moderate: slope.	Slight	Slight	Year round.
SaD:					
Sarona	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
Pence	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
SbB Sarwet	Slight	Slight	Slight	Slight	Year round.
ScB Sconsin	Slight	Slight	Slight	Slight	Year round.
VsB:					
Vilas	Slight	Slight	Slight	Slight	Year round.
Sayner	Slight	Slight	Slight	Slight	Year round.
VsC:					
Vilas	Slight	Moderate: slope.	Slight	Slight	Year round.
Sayner	Slight	Moderate: slope.	Slight	Slight	Year round.
VsD:					
Vilas	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
Sayner	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
WoA Worcester	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
WsA Worwood	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.

TABLE 8.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
AoB------------- Antigo	IIe	85	14	70	4.0	3.5	3.2
AoC------------- Antigo	IIIe	75	12	65	3.5	2.5	3.0
AuA------------- Au Gres	IVw	---	---	---	---	---	2.0
AxA------------- Augwood	IVw	---	---	---	---	---	2.2
CoA------------- Comstock	IIw	80	13	70	4.0	3.5	4.0
CpA------------- Comstock-Magnor	IIw	80	13	70	4.0	3.5	4.0
CrB------------- Croswell	IVs	50	8	50	2.5	2.0	1.8
CsB------------- Croswood	IVs	55	9	55	3.0	2.5	2.0
CyB------------- Crystal Lake	IIe	90	15	75	4.5	3.5	4.0
CyC------------- Crystal Lake	IIIe	75	12	65	4.0	3.0	3.7
Fh-------------- Fordum	VIw	---	---	---	---	---	---
FoB------------- Freeon	IIe	85	14	70	4.5	3.5	3.5
FoC------------- Freeon	IIIe	75	12	65	4.0	3.0	3.3
FsB------------- Freeon-Sconsin	IIe	85	14	70	4.0	3.5	3.5
GoC------------- Goodman	IIIe	70	12	65	4.0	3.0	3.5
GwB------------- Goodwit	IIe	90	15	75	4.5	3.5	3.7
HyB------------- Hatley	IIw	80	13	70	4.0	3.5	4.0
KwC------------- Keweenaw	VIs	65	10	60	3.5	2.5	1.8
KwD------------- Keweenaw	VIIs	---	---	---	---	---	1.3

See footnote at end of table.

TABLE 8.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
Lo-------------- Loxley and Dawson	VIIw	---	---	---	---	---	---
Lu-------------- Lupton, Cathro, and Markey	VIw	---	---	---	---	---	---
MaB------------- Magnor	IIw	80	13	70	4.0	3.5	3.7
MgB------------- Magnor-Ossmer	IIw	80	13	70	4.0	3.5	3.7
MkB------------- Magroc	IIw	---	---	---	---	---	3.7
MoB------------- Mequithy	IIe	80	13	70	4.0	3.0	3.0
MoC------------- Mequithy	IIIe	70	11	65	3.5	2.5	2.5
Ms-------------- Minocqua and Capitola	VIw	---	---	---	---	---	---
MxB------------- Moodig	IIw	80	13	70	4.0	3.0	3.2
NeC------------- Newood	IIIe	70	11	65	3.5	2.5	2.5
NoB------------- Newood	IIe	80	13	70	4.0	3.0	3.0
NpC------------- Newood-Pence	IVe	65	10	60	3.5	2.5	2.0
NwD------------- Newot	VIe	---	---	---	---	---	1.5
OsA------------- Ossmer	IIw	80	13	70	4.0	3.5	3.5
PaB------------- Padwet	IIe	80	13	70	4.0	3.0	2.5
PbB------------- Padwood	IIe	85	14	70	4.0	3.0	2.8
PbC------------- Padwood	IIIe	70	11	65	3.5	2.5	2.6
PcC------------- Pence-Antigo	IVe	65	10	60	3.5	2.5	2.0
PeB------------- Pence-Padus	IIIe	65	10	60	3.5	2.5	2.0

See footnote at end of table.

TABLE 8.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
PeC------------- Pence-Padus	IVe	60	9	55	3.0	2.5	1.8
PeD------------- Pence-Padus	VIIe	---	---	---	---	---	1.3
PsB------------- Pesabic	IIw	75	12	65	4.0	3.0	3.2
Pt. Pits							
SaC------------- Sarona-Pence	IVe	70	11	65	3.5	2.5	2.2
SaD------------- Sarona-Pence	VIIe	---	---	---	---	---	1.3
SbB------------- Sarwet	IIe	85	14	70	4.0	3.0	3.0
ScB------------- Sconsin	IIe	90	15	70	4.0	3.5	3.5
VsB------------- Vilas-Sayner	IVs	50	8	50	2.5	2.0	1.2
VsC------------- Vilas-Sayner	VIs	---	---	---	---	---	0.7
VsD------------- Vilas-Sayner	VIIs	---	---	---	---	---	0.5
WoA------------- Worcester	IIw	75	12	65	4.0	3.0	2.7
WsA------------- Worwood	IIw	80	13	70	4.0	3.0	2.8

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(Only the soils suitable for windbreaks and environmental plantings are listed. The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AoB, AoC: Antigo	Manyflower cotoneaster.	Gray dogwood, American cranberrybush, Amur maple, lilac, northern whitecedar, Siberian peashrub, silky dogwood.	Norway spruce	Jack pine, red pine, eastern white pine.	---
AuA: Au Gres	---	American cranberrybush, Amur maple, common ninebark, nannyberry viburnum, northern whitecedar.	White spruce, Manchurian crabapple, Norway spruce.	Green ash, eastern white pine, jack pine.	Imperial Carolina poplar.
AxA: Augwood	---	Silky dogwood, northern whitecedar, American cranberrybush, lilac, nannyberry viburnum, Roselow sargent crabapple.	White spruce, Manchurian crabapple, Norway spruce.	Eastern white pine, red pine, green ash.	---
CoA: Comstock	---	Nannyberry viburnum, northern whitecedar, lilac, American cranberrybush, silky dogwood, redosier dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---
CpA:					
Comstock	---	Nannyberry viburnum, northern whitecedar, lilac, American cranberrybush, silky dogwood, redosier dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---
Magnor	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
CrB: Croswell	Manyflower cotoneaster.	Amur maple, lilac, northern whitecedar, Siberian peashrub.	---	Eastern white pine, red pine, jack pine.	---
CsB: Croswood	Manyflower cotoneaster.	Siberian peashrub, lilac, smooth sumac, northern whitecedar, staghorn sumac.	Manchurian crabapple, Austrian pine.	Eastern white pine, red pine, jack pine.	---
CyB, CyC: Crystal Lake	---	Gray dogwood, Amur maple, American cranberrybush, lilac, northern whitecedar.	Black Hills spruce, Norway spruce, white spruce.	Eastern white pine, red pine, white ash, red maple.	---
FoB, FoC: Freeon	---	Amur maple, lilac, American cranberrybush, northern whitecedar, gray dogwood.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---
FsB:					
Freeon	---	Amur maple, lilac, American cranberrybush, northern whitecedar, gray dogwood.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---
Sconsin	Manyflower cotoneaster.	Silky dogwood, Amur maple, lilac, gray dogwood, Siberian peashrub, American cranberrybush, northern whitecedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
GoC: Goodman	---	Amur maple, northern whitecedar, gray dogwood, lilac, American cranberrybush.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---
GwB: Goodwit	---	Amur maple, northern whitecedar, gray dogwood, lilac, American cranberrybush.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
HyB: Hatley	---	Northern whitecedar, lilac, American cranberrybush, silky dogwood, nannyberry viburnum, redosier dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---
KwC, KwD: Keweenaw	---	Lilac, northern whitecedar, Amur maple, Siberian peashrub, Peking cotoneaster.	Manchurian crabapple, white spruce, Norway spruce.	Red pine, eastern white pine, jack pine.	Imperial Carolina poplar.
Lo:					
Loxley	---	Common ninebark, nannyberry viburnum, silky dogwood, lilac, American cranberrybush, gray dogwood.	Siberian crabapple, northern whitecedar, Norway spruce.	Eastern white pine, green ash.	Carolina poplar.
Dawson.					
MaB: Magnor	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---
MgB:					
Magnor	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---
Ossmer	---	Nannyberry viburnum, American cranberrybush, redosier dogwood, lilac, northern whitecedar, silky dogwood.	White spruce	Red maple, silver maple, white ash, red pine, eastern white pine.	---
MkB: Magroc	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
MoB, MoC: Mequithy	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
MxB: Moodig	---	Silky dogwood, northern whitecedar, nannyberry viburnum, redosier dogwood, common ninebark, lilac, American cranberrybush.	White spruce	Red maple, eastern white pine, white ash, silver maple.	---
NeC, NoB: Newood	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
NpC:					
Newood	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Pence	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
NwD: Newot	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
OsA: Ossmer	---	Nannyberry viburnum, American cranberrybush, redosier dogwood, lilac, northern whitecedar, silky dogwood.	White spruce	Red maple, silver maple, white ash, red pine, eastern white pine.	---
PaB: Padwet	Manyflower cotoneaster.	Gray dogwood, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, lilac, northern whitecedar.	Norway spruce	Jack pine, red pine, eastern white pine.	---
PbB, PbC: Padwood	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
PcC: Pence	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Antigo	Manyflower cotoneaster.	Gray dogwood, American cranberrybush, Amur maple, lilac, Siberian peashrub, silky dogwood, northern whitecedar.	Norway spruce	Jack pine, red pine, eastern white pine.	---
PeB, PeC, PeD: Pence	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
PeB, PeC, PeD:					
Padus	Manyflower cotoneaster.	Gray dogwood, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, lilac, northern whitecedar.	Norway spruce	Jack pine, red pine, eastern white pine.	---
PsB: Pesabic	Manyflower cotoneaster.	Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
SaC, SaD:					
Sarona	Manyflower cotoneaster.	Northern whitecedar, Siberian peashrub, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Pence	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
SbB: Sarwet	Manyflower cotoneaster.	Siberian peashrub, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood, northern whitecedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
ScB: Sconsin	Manyflower cotoneaster.	Silky dogwood, northern whitecedar, Amur maple, lilac, gray dogwood, Siberian peashrub, American cranberrybush.	Norway spruce	Eastern white pine, red pine, jack pine.	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
VsB, VsC, VsD:					
Vilas	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Sayner	Manyflower cotoneaster.	Siberian peashrub, lilac, northern whitecedar, Amur maple, American cranberrybush, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
WoA Worcester	---	Common ninebark, northern whitecedar, nannyberry viburnum, American cranberrybush, redosier dogwood, silky dogwood, lilac.	White spruce	Eastern white pine, silver maple, red maple, white ash.	---
WsA Worwood	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AoB: Antigo	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
AoC: Antigo	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
AuA: Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
AxA: Augwood	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
CoA: Comstock	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
CpA:					
Comstock	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Magnor	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.
CrB: Croswell	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
CsB: Croswood	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Severe: droughty.
CyB: Crystal Lake	Slight	Slight	Moderate: slope.	Slight	Slight.
CyC: Crystal Lake	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Fh: Fordum	Severe: flooding, ponding.	Severe: ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: flooding, ponding.
FoB: Freeon	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
FoC: Freeon	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FsB:					
Freeon	Moderate: wetness.	Moderate: wetness.	Moderate: slope, small stones, wetness.	Severe: erodes easily.	Slight.
Sconsin	Slight	Slight	Moderate: slope.	Slight	Moderate: large stones.
GoC: Goodman	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: large stones, slope.
GwB: Goodwit	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
HyB: Hatley	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.
KwC: Keweenaw	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
KwD: Keweenaw	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lo:					
Loxley	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.	Severe: too acid, ponding, excess humus.
Dawson	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Lu:					
Lupton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Cathro	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Markey	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
MaB: Magnor	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.
MgB:					
Magnor	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MgB:					
Ossmer	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.
MkB: Magroc	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.
MoB: Mequithy	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight	Moderate: large stones, depth to rock.
MoC: Mequithy	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope, depth to rock.
Ms:					
Minocqua	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Capitola	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
MxB: Moodig	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
NeC: Newood	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
NoB: Newood	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Moderate: large stones, droughty.
NpC:					
Newood	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
Pence	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
NwD: Newot	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
OsA: Ossmer	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
PaB------------------- Padwet	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Moderate: small stones, large stones, droughty.
PbB------------------- Padwood	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: large stones, droughty.
PbC------------------- Padwood	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, droughty, slope.
PcC:					
Pence----------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, droughty, slope.
Antigo---------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
PeB:					
Pence----------------	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: large stones, droughty.
Padus----------------	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Moderate: small stones, large stones.
PeC:					
Pence----------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, droughty, slope.
Padus----------------	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight----------	Moderate: small stones, large stones, slope.
PeD:					
Pence----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Padus----------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
PsB------------------- Pesabic	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Pt. Pits					

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SaC:					
Sarona	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
Pence	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
SaD:					
Sarona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pence	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SbB Sarwet	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, large stones, droughty.
ScB Sconsin	Slight	Slight	Moderate: slope.	Slight	Moderate: large stones.
VsB:					
Vilas	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
Sayner	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Severe: droughty.
VsC:					
Vilas	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
Sayner	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Severe: droughty.
VsD:					
Vilas	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sayner	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
WoA Worcester	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
WsA Worwood	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AoB----------------- Antigo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AoC----------------- Antigo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AuA----------------- Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
AxA----------------- Augwood	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
CoA----------------- Comstock	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
CpA:										
Comstock----------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Magnor------------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CrB----------------- Croswell	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
CsB----------------- Croswood	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
CyB----------------- Crystal Lake	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CyC----------------- Crystal Lake	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Fh------------------ Fordum	Very poor.	Very poor.	Poor	Fair	Fair	Good	Good	Very poor.	Fair	Good.
FoB----------------- Freeon	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
FoC----------------- Freeon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FsB:										
Freeon------------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Sconsin-----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
GoC----------------- Goodman	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
GwB----------------- Goodwit	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HyB----------------- Hatley	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
KwC: Keweenaw	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
KwD: Keweenaw	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Lo:										
Loxley	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Dawson	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Lu:										
Lupton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Cathro	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Markey	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
MaB: Magnor	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
MgB:										
Magnor	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ossmer	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
MkB: Magroc	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
MoB: Mequithy	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MoC: Mequithy	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ms:										
Minocqua	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Capitola	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
MxB: Moodig	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
NeC: Newood	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
NoB: Newood	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
NpC:										
Newood	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Pence	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
NwD: Newot	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
OsA: Ossmer	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
PaB: Padwet	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PbB: Padwood	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PbC: Padwood	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
PcC:										
Pence	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Antigo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
PeB, PeC:										
Pence	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Padus	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
PeD:										
Pence	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Padus	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
PsB: Pesabic	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Good.
Pt. Pits										
SaC:										
Sarona	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Pence	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
SaD:										
Sarona	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Pence	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
SbB: Sarwet	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ScB: Sconsin	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
VsB, VsC:										
Vilas	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Sayner	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
VsD:										
Vilas	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Sayner	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
WoA: Worcester	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
WsA: Worwood	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AoB--------------- Antigo	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Severe: frost action.	Slight.
AoC--------------- Antigo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
AuA--------------- Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
AxA--------------- Augwood	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
CoA--------------- Comstock	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
CpA:						
Comstock---------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Magnor-----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness.
CrB--------------- Croswell	Severe: cutbanks cave, wetness.	Slight---------	Moderate: wetness.	Moderate: wetness.	Slight---------	Moderate: droughty.
CsB--------------- Croswood	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Severe: droughty.
CyB--------------- Crystal Lake	Moderate: cutbanks cave, wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
CyC--------------- Crystal Lake	Moderate: cutbanks cave, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Fh---------------- Fordum	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding, frost action.	Severe.
FoB--------------- Freeon	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Slight.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
FoC--------------- Freeon	Severe: cutbanks cave, wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: wetness, slope, frost action.	Moderate: slope.
FsB:						
Freeon-----------	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Slight.
Sconsin----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
GoC--------------- Goodman	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
GwB--------------- Goodwit	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
HyB--------------- Hatley	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness.
KwC--------------- Keweenaw	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
KwD--------------- Keweenaw	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lo:						
Loxley-----------	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: too acid, ponding, excess humus.
Dawson-----------	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Lu:						
Lupton-----------	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Cathro-----------	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Markey-----------	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
MaB: Magnor	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness.
MgB:						
Magnor	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness.
Ossmer	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness.
MkB: Magroc	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness.
MoB: Mequithy	Severe: depth to rock.	Moderate: depth to rock, large stones.	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Moderate: depth to rock, frost action.	Moderate: large stones, depth to rock.
MoC: Mequithy	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Moderate: large stones, slope, depth to rock.
Ms:						
Minocqua	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
Capitola	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
MxB: Moodig	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
NeC: Newood	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
NoB: Newood	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Moderate: large stones, droughty.
NpC:						
Newood	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
Pence	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
NwD Newot	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
OsA Ossmer	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness.
PaB Padwet	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: small stones, large stones, droughty.
PbB Padwood	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Moderate: large stones, droughty.
PbC Padwood	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
PcC:						
Pence	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
Antigo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
PeB:						
Pence	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: large stones, droughty.
Padus	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: small stones, large stones.
PeC:						
Pence	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
Padus	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: small stones, large stones, slope.
PeD:						
Pence	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Padus	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
PsB--------------- Pesabic	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Pt. Pits						
SaC: Sarona------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
Pence------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
SaD: Sarona------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pence------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SbB--------------- Sarwet	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Moderate: small stones, large stones, droughty.
ScB--------------- Sconsin	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: large stones.
VsB: Vilas------------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
Sayner-----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
VsC: Vilas------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Sayner-----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
VsD: Vilas------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sayner-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
WoA--------------- Worcester	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
WsA--------------- Worwood	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "severe," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AoB----------------- Antigo	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
AoC----------------- Antigo	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
AuA----------------- Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
AxA----------------- Augwood	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
CoA----------------- Comstock	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: wetness.
CpA:					
Comstock-----------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: wetness.
Magnor-------------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
CrB----------------- Croswell	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
CsB----------------- Croswood	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
CyB----------------- Crystal Lake	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
CyC----------------- Crystal Lake	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope.	Moderate: wetness, slope.	Fair: slope, wetness.
Fh------------------ Fordum	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, small stones.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
FoB: Freeon	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Poor: small stones.
FoC: Freeon	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope.	Moderate: wetness, slope.	Poor: small stones.
FsB:					
Freeon	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Poor: small stones.
Sconsin	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
GoC: Goodman	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
GwB: Goodwit	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Poor: small stones.
HyB: Hatley	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, small stones, wetness.
KwC: Keweenaw	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
KwD: Keweenaw	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Lo:					
Loxley	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
Dawson	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Lu:					
Lupton	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Cathro	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lu:					
Markey	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
MaB Magnor	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
MgB:					
Magnor	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
Ossmer	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
MkB Magroc	Severe: wetness.	Severe: wetness.	Severe: depth to rock, wetness.	Severe: wetness.	Poor: large stones, wetness.
MoB Mequithy	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, large stones.
MoC Mequithy	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, large stones.
Ms:					
Minocqua	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
Capitola	Severe: ponding, percs slowly.	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Poor: seepage, small stones, ponding.
MxB Moodig	Severe: wetness.	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: small stones, wetness.
NeC Newood	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too sandy.	Moderate: wetness, slope.	Poor: small stones.
NoB Newood	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Moderate: wetness, too sandy.	Moderate: wetness.	Poor: small stones.
NpC:					
Newood	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too sandy.	Moderate: wetness, slope.	Poor: small stones.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
NpC:					
Pence	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
NwD Newot	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
OsA Ossmer	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
PaB Padwet	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
PbB Padwood	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
PbC Padwood	Severe: wetness, percs slowly, poor filter.	Severe: seepage, slope, wetness.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
PcC:					
Pence	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Antigo	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
PeB:					
Pence	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Padus	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
PeC:					
Pence	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PeC:					
Padus	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
PeD:					
Pence	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Padus	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
PsB Pesabic	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
Pt. Pits					
SaC:					
Sarona	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
Pence	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
SaD:					
Sarona	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Pence	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
SbB Sarwet	Severe: wetness.	Severe: wetness.	Moderate: wetness, too sandy, large stones.	Moderate: wetness.	Poor: seepage, small stones.
ScB Sconsin	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
VsB:					
Vilas	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
VsB:					
Sayner	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
VsC:					
Vilas	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Sayner	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
VsD:					
Vilas	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Sayner	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
WoA: Worcester	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
WsA: Worwood	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AoB, AoC: Antigo	Good	Probable	Probable	Poor: small stones, area reclaim.
AuA: Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
AxA: Augwood	Poor: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, small stones, wetness.
CoA: Comstock	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
CpA:				
Comstock	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
Magnor	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
CrB: Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
CsB: Croswood	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, small stones.
CyB: Crystal Lake	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
CyC: Crystal Lake	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Fh: Fordum	Poor: wetness.	Probable	Probable	Poor: small stones, area reclaim, wetness.
FoB, FoC: Freeon	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
FsB:				
Freeon	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
FsB:				
Sconsin	Good	Probable	Probable	Poor: small stones, area reclaim.
GoC Goodman	Good	Probable	Probable	Poor: small stones, area reclaim.
GwB Goodwit	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
HyB Hatley	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
KwC Keweenaw	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.
KwD Keweenaw	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.
Lo:				
Loxley	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness, too acid.
Dawson	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Lu:				
Lupton	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Markey	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
MaB Magnor	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
MgB:				
Magnor	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MgB:				
Ossmer	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
MkB Magroc	Fair: depth to rock, thin layer, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.
MoB, MoC Mequithy	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Ms:				
Minocqua	Poor: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Capitola	Poor: wetness.	Probable	Probable	Poor: small stones, area reclaim, wetness.
MxB Moodig	Poor: wetness.	Probable	Probable	Poor: small stones, area reclaim, wetness.
NeC, NoB Newood	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
NpC:				
Newood	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Pence	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
NwD Newot	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
OsA Ossmer	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
PaB Padwet	Good	Probable	Probable	Poor: small stones, area reclaim.
PbB, PbC Padwood	Fair: wetness.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PcC:				
Pence	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Antigo	Good	Probable	Probable	Poor: small stones, area reclaim.
PeB, PeC:				
Pence	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Padus	Good	Probable	Probable	Poor: small stones, area reclaim.
PeD:				
Pence	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Padus	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
PsB Pesabic	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, wetness.
Pt. Pits				
SaC:				
Sarona	Good	Probable	Probable	Poor: small stones, area reclaim.
Pence	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
SaD:				
Sarona	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Pence	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SbB------------------- Sarwet	Fair: wetness.	Probable-------------	Probable-------------	Poor: small stones, area reclaim.
ScB------------------- Sconsin	Good-----------------	Probable-------------	Probable-------------	Poor: small stones, area reclaim.
VsB, VsC:				
Vilas----------------	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
Sayner---------------	Good-----------------	Probable-------------	Probable-------------	Poor: too sandy, small stones, area reclaim.
VsD:				
Vilas----------------	Poor: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
Sayner---------------	Poor: slope.	Probable-------------	Probable-------------	Poor: too sandy, small stones, area reclaim.
WoA------------------- Worcester	Poor: wetness.	Probable-------------	Probable-------------	Poor: small stones, area reclaim, wetness.
WsA------------------- Worwood	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
AoB: Antigo	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, erodes easily.	Erodes easily, too sandy.	Erodes easily.
AoC: Antigo	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily, too sandy.	Slope, erodes easily.
AuA: Au Gres	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
AxA: Augwood	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
CoA: Comstock	Moderate: seepage.	Severe: piping, wetness.	Frost action, cutbanks cave.	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
CpA:						
Comstock	Moderate: seepage.	Severe: piping, wetness.	Frost action, cutbanks cave.	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
Magnor	Moderate: seepage.	Severe: piping.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
CrB: Croswell	Severe: seepage.	Severe: seepage, piping.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy.	Droughty.
CsB: Croswood	Severe: seepage.	Severe: seepage, piping.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
CyB: Crystal Lake	Moderate: seepage, slope.	Severe: piping.	Frost action, slope.	Slope, wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
CyC: Crystal Lake	Severe: slope.	Severe: piping.	Frost action, slope.	Slope, wetness, erodes easily.	Slope, erodes easily, wetness.	Slope, erodes easily.
Fh: Fordum	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, flooding, frost action.	Ponding, droughty, flooding.	Erodes easily, ponding, too sandy.	Wetness, erodes easily, droughty.
FoB: Freeon	Moderate: slope.	Severe: seepage, piping.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, rooting depth.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
FoC---------------- Freeon	Severe: slope.	Severe: seepage, piping.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
FsB:						
Freeon-----------	Moderate: slope.	Severe: seepage, piping.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, rooting depth.
Sconsin----------	Severe: seepage.	Severe: seepage.	Deep to water	Slope, rooting depth, erodes easily.	Erodes easily, too sandy.	Erodes easily, rooting depth.
GoC---------------- Goodman	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, rooting depth, erodes easily.	Slope, erodes easily, too sandy.	Slope, erodes easily, rooting depth.
GwB---------------- Goodwit	Moderate: seepage, slope.	Severe: seepage, piping.	Slope----------	Slope, wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
HyB---------------- Hatley	Severe: seepage.	Severe: seepage, wetness.	Frost action, cutbanks cave.	Wetness, erodes easily.	Large stones, erodes easily, wetness.	Large stones, wetness, erodes easily.
KwC, KwD---------- Keweenaw	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Lo:						
Loxley-----------	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides, frost action.	Ponding, too acid.	Ponding--------	Wetness.
Dawson-----------	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides, frost action.	Ponding, rooting depth.	Ponding--------	Wetness, rooting depth.
Lu:						
Lupton-----------	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
Cathro-----------	Severe: seepage.	Severe: piping, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
Markey-----------	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
MaB---------------- Magnor	Moderate: seepage.	Severe: piping.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
MgB:						
Magnor-----------	Moderate: seepage.	Severe: piping.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
MgB:						
Ossmer	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, rooting depth, erodes easily.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, rooting depth.
MkB Magroc	Moderate: seepage, depth to rock.	Severe: seepage, piping.	Large stones, frost action.	Large stones, wetness.	Large stones, erodes easily, wetness.	Large stones, wetness, erodes easily.
MoB Mequithy	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope, large stones, depth to rock.	Large stones, depth to rock, erodes easily.	Large stones, depth to rock, erodes easily.
MoC Mequithy	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Ms:						
Minocqua	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, frost action, cutbanks cave.	Ponding, rooting depth.	Erodes easily, ponding, too sandy.	Wetness, erodes easily.
Capitola	Moderate: seepage.	Severe: seepage, piping, ponding.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing, rooting depth.	Large stones, erodes easily, ponding.	Large stones, wetness, erodes easily.
MxB Moodig	Moderate: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, droughty.	Large stones, wetness, too sandy.	Large stones, wetness, droughty.
NeC Newood	Severe: slope.	Severe: seepage, piping.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Slope, wetness, too sandy.	Slope, droughty, rooting depth.
NoB Newood	Moderate: seepage, slope.	Severe: seepage, piping.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy.	Droughty, rooting depth.
NpC:						
Newood	Severe: slope.	Severe: seepage, piping.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Slope, wetness, too sandy.	Slope, droughty, rooting depth.
Pence	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
NwD Newot	Severe: slope.	Severe: piping.	Deep to water	Slope, droughty, soil blowing.	Slope, soil blowing, percs slowly.	Slope, droughty, rooting depth.
OsA Ossmer	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, rooting depth, erodes easily.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, rooting depth.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
PaB: Padwet	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
PbB: Padwood	Severe: seepage.	Severe: seepage, piping.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy.	Droughty, rooting depth.
PbC: Padwood	Severe: seepage, slope.	Severe: seepage, piping.	Slope, cutbanks cave.	Slope, wetness, droughty.	Slope, wetness, too sandy.	Slope, droughty, rooting depth.
PcC:						
Pence	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty, rooting depth.
Antigo	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily, too sandy.	Slope, erodes easily.
PeB:						
Pence	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty, rooting depth.
Padus	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
PeC, PeD:						
Pence	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
Padus	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
PsB: Pesabic	Moderate: seepage.	Severe: seepage, piping, wetness.	Percs slowly, frost action.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty, rooting depth.
Pt. Pits						
SaC, SaD:						
Sarona	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty.
Pence	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
SbB: Sarwet	Moderate: seepage, slope.	Severe: seepage, piping.	Slope, cutbanks cave.	Slope, wetness, droughty.	Large stones, wetness, too sandy.	Large stones, droughty, rooting depth.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
ScB: Sconsin	Severe: seepage.	Severe: seepage.	Deep to water	Slope, rooting depth, erodes easily.	Erodes easily, too sandy.	Erodes easily, rooting depth.
VsB:						
Vilas	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Sayner	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty, rooting depth.
VsC, VsD:						
Vilas	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Sayner	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
WoA: Worcester	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, droughty, soil blowing.	Wetness, too sandy, soil blowing.	Wetness, droughty, rooting depth.
WsA: Worwood	Severe: seepage.	Severe: piping, wetness.	Frost action, cutbanks cave.	Wetness, droughty, soil blowing.	Wetness, too sandy, soil blowing.	Wetness, droughty, rooting depth.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
AoB, AoC------ Antigo	0-4	Silt loam-----	ML, CL-ML	A-4	0	0-3	95-100	90-100	70-100	65-85	<25	2-7
	4-17	Silt loam-----	ML, CL-ML	A-4	0	0-3	95-100	90-100	70-100	65-85	15-25	2-7
	17-21	Silt loam-----	CL, CL-ML	A-4	0	0-3	95-100	90-100	70-100	65-85	20-30	4-9
	21-31	Sandy loam, loam, gravelly sandy loam.	SM, GM, ML, GM-GC	A-2, A-4, A-1, A-3	0	0-9	50-100	45-100	25-95	7-75	<30	NP-9
	31-60	Coarse sand, sand, sand and gravel.	SP, SP-SM, GP, GP-GM	A-2, A-3, A-1	0	0-9	30-100	25-100	10-70	1-12	---	NP
AuA----------- Au Gres	0-5	Loamy sand----	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	0	95-100	75-100	35-75	10-30	<25	NP-7
	5-21	Sand, loamy sand.	SP-SM, SM, SC-SM, SP	A-2-4, A-3, A-1-b	0	0	95-100	75-100	35-75	0-30	<25	NP-7
	21-60	Sand----------	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	0	95-100	75-100	35-70	0-15	---	NP
AxA----------- Augwood	0-1	Loamy sand----	SM, SP-SM	A-1, A-2	0	0-9	80-100	75-100	30-75	10-35	---	NP
	1-3	Sand, loamy sand.	SM, SP	A-1, A-2, A-3	0	0-9	80-100	75-100	20-70	4-25	---	NP
	3-21	Loamy sand, sand.	SM, SP	A-1, A-2, A-3	0	0-9	80-100	75-100	20-70	4-35	---	NP
	21-55	Sand----------	SM, SP	A-1, A-2, A-3	0	0-9	80-100	75-100	20-70	4-25	---	NP
	55-60	Gravelly sandy loam, sandy loam.	SM, SC-SM	A-2, A-4	0-1	0-15	55-100	50-95	35-75	15-45	<25	NP-7
CoA----------- Comstock	0-2	Silt loam-----	CL-ML, CL, ML	A-4, A-6	0	0	100	100	90-100	70-100	15-35	3-15
	2-16	Silt loam-----	CL-ML, CL, ML	A-4, A-6	0	0	100	100	90-100	70-100	15-35	3-15
	16-36	Silt loam, silty clay loam.	CL	A-6, A-4	0	0	100	100	90-100	70-100	25-40	9-20
	36-60	Stratified silt to very fine sand.	CL, ML, CL-ML	A-4, A-6	0	0	100	100	85-100	65-95	<35	NP-15
CpA:												
Comstock-----	0-2	Silt loam-----	CL-ML, CL, ML	A-4, A-6	0	0	100	100	90-100	70-100	15-35	3-15
	2-16	Silt loam-----	CL-ML, CL, ML	A-4, A-6	0	0	100	100	90-100	70-100	15-35	3-15
	16-36	Silt loam, silty clay loam.	CL	A-6, A-4	0	0	100	100	90-100	70-100	25-40	9-20
	36-60	Stratified silt to very fine sand.	CL, ML, CL-ML	A-4, A-6	0	0	100	100	85-100	65-95	<35	NP-15

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
CpA:												
Magnor-------	0-5	Silt loam-----	CL, CL-ML, ML	A-4	0	0-9	90-100	85-100	70-100	60-100	<28	NP-9
	5-15	Silt loam-----	CL, CL-ML, ML	A-4	0-3	0-9	90-100	85-100	70-95	60-95	<28	NP-9
	15-25	Silt loam, silt.	CL, CL-ML, ML	A-4	0-5	0-9	90-100	85-100	70-85	60-85	<28	NP-9
	25-39	Gravelly sandy loam, fine sandy loam, loam.	ML, CL, SM, SC	A-2-4, A-4, A-1-b	0-5	0-15	55-100	50-90	40-85	20-70	15-28	NP-9
	39-60	Sandy loam, loam, gravelly fine sandy loam.	ML, CL-ML, SM, SC-SM	A-2-4, A-4, A-1-b	0-5	0-15	55-100	50-90	40-85	20-70	<25	NP-7
CrB----------- Croswell	0-5	Loamy sand----	SM, SP-SM, SC-SM	A-2, A-1-b	0	0	90-100	85-100	40-75	10-30	<25	NP-7
	5-31	Sand, loamy sand.	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	0	90-100	85-100	40-75	3-30	---	NP
	31-60	Sand----------	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	0	90-100	85-100	40-70	3-15	---	NP
CsB----------- Croswood	0-4	Loamy sand----	SM, SP-SM	A-1, A-2	0	0-9	80-100	75-100	30-75	10-35	---	NP
	4-6	Sand, loamy sand.	SM, SP	A-1, A-2, A-3	0	0-9	80-100	75-100	20-70	4-35	---	NP
	6-22	Loamy sand, sand.	SM, SP	A-1, A-2, A-3	0	0-9	80-100	75-100	20-70	4-35	---	NP
	22-55	Sand----------	SM, SP	A-1, A-2, A-3	0	0-9	80-100	75-100	20-70	4-25	---	NP
	55-80	Gravelly sandy loam, sandy loam.	SM, SC-SM	A-2, A-4	0-1	0-15	60-100	55-95	35-75	15-45	<25	NP-7
CyB, CyC------ Crystal Lake	0-11	Silt loam-----	CL-ML, CL, ML	A-4, A-6	0	0-2	98-100	97-100	85-100	70-100	19-32	3-13
	11-38	Silt loam, silty clay loam.	CL	A-6, A-4	0	0-2	98-100	97-100	90-100	85-100	25-40	7-18
	38-60	Silt loam, silt.	CL, CL-ML, ML	A-4, A-6	0	0-2	98-100	97-100	75-100	60-90	18-30	NP-11
Fh------------ Fordum	0-9	Loam----------	ML, CL, SM, SC	A-4, A-6, A-2	0	0-5	80-100	75-100	55-100	45-85	20-35	3-15
	9-31	Mucky loam, sandy loam, loam.	SM, SC, ML, CL	A-2, A-4	0	0-5	80-100	75-100	45-100	20-90	<30	3-10
	31-60	Stratified very gravelly sand and sand.	SP, SM, GP, SM	A-3, A-2, A-1	0	0-15	30-100	25-100	7-95	1-50	---	NP

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
FoB, FoC------ Freeon	0-1	Silt loam-----	ML, CL, CL-ML	A-4	0	0-9	90-100	85-100	70-100	60-95	<30	NP-10
	1-20	Silt loam-----	ML, CL, CL-ML	A-4	0-5	0-9	90-100	85-100	70-100	60-95	<30	NP-10
	20-31	Sandy loam, gravelly loamy sand, loam.	ML, CL, SP-SM, SC	A-4, A-1, A-2, A-3	0-5	0-15	55-95	50-90	20-85	7-70	<30	NP-10
	31-42	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0-5	0-15	55-95	50-90	30-85	15-70	<25	NP-7
	42-60	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0-5	0-15	55-95	50-90	30-85	15-70	<25	NP-7
FsB:												
Freeon-------	0-1	Silt loam-----	ML, CL, CL-ML	A-4	0	0-9	90-100	85-100	70-100	60-95	<30	NP-10
	1-20	Silt loam-----	ML, CL, CL-ML	A-4	0-5	0-9	90-100	85-100	70-100	60-95	<30	NP-10
	20-31	Sandy loam, gravelly loamy sand, loam.	ML, CL, SP-SM, SC	A-4, A-1, A-2, A-3	0-5	0-15	55-95	50-90	20-85	7-70	<30	NP-10
	31-42	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0-5	0-15	55-95	50-90	30-85	15-70	<25	NP-7
	42-60	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0-5	0-15	55-95	50-90	30-85	15-70	<25	NP-7
Sconsin------	0-4	Silt loam-----	ML, CL-ML	A-4	0	0-4	95-100	90-100	70-100	65-85	18-25	3-7
	4-27	Silt loam-----	ML, CL-ML	A-4	0	0-9	95-100	90-100	70-100	65-85	<25	NP-7
	27-34	Loam, gravelly sandy loam.	CL, ML, SM, SC	A-4, A-2, A-1-b	0	0-9	60-100	55-95	30-90	20-75	<28	NP-9
	34-38	Sandy loam, gravelly loam, very gravelly loamy sand.	CL, ML, SM, SC	A-4, A-2, A-1-b	0	0-9	60-100	55-95	30-90	20-75	18-28	3-9
	38-60	Gravelly sand, sand, very gravelly coarse sand.	GP, GM, SP, SM	A-2-4, A-3, A-1-a	0	0-9	40-90	30-85	7-60	1-30	---	NP
GoC----------- Goodman	0-5	Silt loam-----	ML, CL-ML	A-4	0	0-10	90-100	85-100	85-100	75-100	<23	NP-6
	5-6	Silt loam-----	ML	A-4	0	0-10	90-100	85-100	85-100	75-100	<21	NP-4
	6-15	Silt loam-----	ML, CL-ML	A-4	0-1	0-10	90-100	85-100	70-100	60-90	<25	NP-7
	15-24	Silt loam-----	ML, CL-ML	A-4	0-3	0-10	90-100	85-100	70-100	60-90	<25	NP-7
	24-50	Sandy loam, gravelly sandy loam, loam.	ML, CL-ML, SM, SP-SM	A-4, A-1-b, A-2-4	0-5	0-10	65-100	55-95	20-90	8-75	<23	NP-6
	50-60	Sandy loam, gravelly sandy loam.	SC-SM, SM, SP-SM	A-4, A-1-b, A-2-4	0-5	0-10	65-100	55-95	20-85	8-50	<23	NP-6

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments >10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
GwB----------- Goodwit	0-2	Silt loam-----	ML, CL-ML	A-4	0	0-15	90-100	85-100	70-100	60-90	<23	NP-6
	2-3	Silt loam-----	ML	A-4	0	0-15	90-100	85-100	70-100	60-100	<21	NP-4
	3-15	Silt loam-----	ML, CL-ML	A-4	0-1	0-15	90-100	85-100	70-100	60-90	<25	NP-7
	15-30	Fine sandy loam, gravelly loamy sand, sandy loam.	ML, SM, SP-SM	A-4, A-2-4, A-3, A-1	0-5	0-15	60-100	55-95	20-90	8-75	<21	NP-4
	30-50	Sandy loam, gravelly fine sandy loam, loam.	ML, CL-ML, SM, SC-SM	A-4, A-1-b, A-2-4	0-5	0-15	60-100	55-95	35-90	15-75	<25	NP-7
	50-60	Sandy loam, gravelly loamy sand.	SC-SM, SM, SP-SM	A-3, A-1, A-2-4	0-5	0-15	60-100	55-95	20-75	8-45	<23	NP-6
HyB----------- Hatley	0-3	Silt loam-----	CL, CL-ML	A-4	0	0-10	85-100	80-100	70-100	55-90	<26	4-8
	3-6	Silt loam-----	ML, CL-ML	A-4	0	0-10	75-100	75-100	65-100	50-90	<26	NP-6
	6-14	Silt loam, gravelly silt loam.	CL, ML, CL-ML	A-4	0-3	0-10	75-100	75-100	65-100	50-90	8-20	NP-10
	14-46	Loam, gravelly sandy loam, sandy loam.	SM, SC, ML, CL	A-4, A-2-4, A-1-b	0-3	0-20	70-95	65-90	40-85	20-70	20-32	NP-10
	46-60	Sandy loam, gravelly sandy loam.	SM, SP-SM	A-2-4, A-1-b	0-3	0-25	70-95	60-90	30-70	10-35	<20	NP-4
KwC, KwD------ Keweenaw	0-4	Sandy loam----	SM, SC, SC-SM	A-2, A-4, A-1-b	0	0-10	90-100	75-100	45-70	15-40	<20	NP-10
	4-20	Sandy loam, loamy sand, sand.	SM, SC, SC-SM, SP-SM	A-2, A-1-b, A-4, A-3	0	0-25	85-100	75-100	30-85	5-45	<20	NP-10
	20-43	Sand, loamy sand, sandy loam.	SM, SC, SP-SM, SC-SM	A-2, A-3, A-1-b, A-4	0	0-25	85-100	60-100	30-85	5-45	<20	NP-10
	43-60	Sandy loam, loamy sand, sand.	SM, SC, SP-SM, SC-SM	A-2, A-3, A-1-b, A-4	0	0-25	85-100	60-100	30-85	5-50	<30	NP-10
Lo: Loxley-------	0-20	Peat----------	PT	A-8	0	0	---	---	---	---	---	---
	20-60	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
Dawson-------	0-8	Peat----------	PT	A-8	0	0	---	---	---	---	---	---
	8-40	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
	40-60	Sand, gravelly sand, gravelly loamy sand.	SP, SM, SC, GP	A-2, A-3, A-1, A-4	0	0	60-100	55-100	15-90	0-45	<20	NP-10
Lu: Lupton-------	0-24	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
	24-60	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
Cathro-------	0-15	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
	15-28	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
	28-60	Loam, silty clay loam, sandy loam.	SC-SM, CL-ML, SC, CL	A-4, A-6	0	0-5	80-100	65-100	60-100	35-90	20-40	4-20

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
Lu:												
Markey--------	0-36	Muck----------	PT	A-8	---	---	---	---	---	---	---	---
	36-60	Sand, loamy sand.	SP, SM, SP-SM	A-2, A-3, A-1	0	0	95-100	75-100	30-75	0-30	---	NP
MaB------------ Magnor	0-5	Silt loam-----	CL, CL-ML, ML	A-4	0	0-9	90-100	85-100	70-100	60-100	<28	NP-9
	5-15	Silt loam, silt.	CL, CL-ML, ML	A-4	0-3	0-9	90-100	85-100	70-95	60-95	<28	NP-9
	15-25	Silt loam, silt.	CL, CL-ML, ML	A-4	0-5	0-9	90-100	85-100	70-85	60-85	<28	NP-9
	25-39	Gravelly sandy loam, fine sandy loam, loam.	ML, CL, SM, SC	A-2-4, A-4, A-1-b	0-5	0-15	55-100	50-90	40-85	20-70	15-28	NP-9
	39-60	Sandy loam, loam, gravelly fine sandy loam.	ML, CL-ML, SM, SC-SM	A-2-4, A-4, A-1-b	0-5	0-15	55-100	50-90	40-85	20-70	<25	NP-7
MgB:												
Magnor--------	0-5	Silt loam-----	CL, CL-ML, ML	A-4	0	0-9	90-100	85-100	70-100	60-100	<28	NP-9
	5-15	Silt loam, silt.	CL, CL-ML, ML	A-4	0-3	0-9	90-100	85-100	70-95	60-95	<28	NP-9
	15-25	Silt loam, silt.	CL, CL-ML, ML	A-4	0-5	0-9	90-100	85-100	70-85	60-85	<28	NP-9
	25-39	Gravelly sandy loam, fine sandy loam, loam.	ML, CL, SM, SC	A-2-4, A-4, A-1-b	0-5	0-15	55-100	50-90	40-85	20-70	15-28	NP-9
	39-60	Sandy loam, loam, gravelly fine sandy loam.	ML, CL-ML, SM, SC-SM	A-2-4, A-4, A-1-b	0-5	0-15	55-100	50-90	40-85	20-70	<25	NP-7
Ossmer--------	0-4	Silt loam-----	ML, CL-ML	A-4	0	0-9	95-100	90-100	70-100	65-85	18-25	3-7
	4-6	Silt loam-----	CL-ML, ML	A-4	0	0-9	95-100	90-100	70-100	65-85	<25	NP-7
	6-26	Silt loam-----	ML, CL, CL-ML	A-4	0-1	0-9	75-100	90-100	70-100	65-85	15-28	NP-9
	26-38	Loam, gravelly sandy loam.	SM, SC, CL, ML	A-2, A-1, A-4	0-3	0-9	55-100	50-100	30-95	15-80	<28	NP-9
	38-60	Stratified sand to very gravelly coarse sand.	SM, SP, GM, GP	A-1, A-3, A-2	0-3	0-9	30-100	25-100	7-70	1-25	---	NP
MkB------------ Magroc	0-4	Silt loam-----	ML, CL, CL-ML	A-4	0	0-15	90-100	85-100	70-100	60-85	<28	NP-9
	4-21	Silt loam-----	ML, CL, CL-ML	A-4	0-3	0-15	90-100	85-100	70-100	60-85	<28	NP-9
	21-42	Loam, sandy loam, gravelly sandy loam.	ML, CL, SM, SC	A-2, A-4, A-1	0-10	0-45	60-100	55-95	35-90	15-75	<28	NP-9
	42-46	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
MoB, MoC------ Mequithy	0-4	Silt loam-----	ML, CL, CL-ML	A-4	0	0-15	80-100	75-100	60-100	50-90	<30	NP-10
	4-19	Loam, silt loam, fine sandy loam.	SM, SC, ML, CL	A-2, A-4, A-6	0-10	0-15	80-100	75-100	50-100	30-90	<35	NP-12
	19-38	Sandy loam, loam, cobbly loam.	SM, SC, ML, CL	A-2, A-4, A-1	0-25	0-45	60-100	55-95	35-95	20-75	<30	NP-10
	38-42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Ms:												
Minocqua-----	0-4	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
	4-33	Silt loam, loam, gravelly loam.	SC, SM, CL, ML	A-2, A-4, A-6	0-1	0-9	80-100	75-100	45-100	25-90	<35	NP-13
	33-37	Sand, loamy sand, very gravelly coarse sand.	SM, GM, GP, SP	A-2, A-1, A-3, A-4	0-1	0-9	40-100	35-100	5-70	2-40	<20	NP-4
	37-60	Coarse sand, sand, very gravelly sand.	SP, SM, GP, GM	A-1, A-3, A-2	0-1	0-9	30-100	25-100	5-70	0-30	---	NP
Capitola-----	0-5	Muck----------	PT	A-8	0	0	---	---	---	---	---	NP
	5-7	Silt loam-----	CL, CL-ML	A-4	0	0-15	80-100	75-100	60-100	50-90	23-26	6-8
	7-22	Silt loam, loam, sandy loam.	CL, ML, SM, SC	A-4, A-2-4	0-5	0-15	80-100	75-100	45-100	20-90	<28	NP-9
	22-33	Fine sandy loam, sandy loam, gravelly sandy loam.	SM, SC	A-4, A-1-b, A-2-4	0-10	0-25	65-100	55-95	35-85	15-50	<26	NP-8
	33-60	Fine sandy loam, sandy loam, gravelly loamy sand.	SM, SP-SM	A-4, A-1-b, A-2-4	0-10	0-25	65-100	55-95	20-85	8-50	<21	NP-4
MxB----------- Moodig	0-3	Sandy loam----	SM, SC	A-2-4, A-4	0	0-15	80-100	75-100	45-80	20-50	<25	NP-8
	3-5	Gravelly sandy loam, loam, loamy sand.	SM, SC, CL, ML	A-2-4, A-4, A-1-b	0-1	0-25	60-100	55-95	35-90	15-75	<25	NP-8
	5-22	Gravelly sandy loam, loam, fine sandy loam.	SM, SC, CL, ML	A-2-4, A-4, A-1-b	0-3	0-25	60-100	55-95	35-90	15-75	<25	NP-8
	22-53	Sandy loam, loamy sand, gravelly loam.	SM, SC, CL, ML	A-2-4, A-4, A-1-b	0-10	0-25	60-95	55-95	35-90	15-75	<25	NP-9
	53-73	Gravelly sandy loam, fine sandy loam.	SM, SC, CL, ML	A-2-4, A-4, A-1-b	0-10	0-25	60-95	55-95	35-90	15-75	<25	NP-9
	73-95	Gravelly sandy loam, sandy loam, loamy sand.	SM, SC-SM, SP-SM	A-2-4, A-4, A-1-b	0-10	0-25	60-95	55-95	20-75	8-45	<25	NP-6

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments >10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
NeC----------- Newood	0-4	Sandy loam----	SM, SC-SM	A-2, A-4	0	0-15	80-100	75-100	40-85	20-50	<25	NP-7
	4-13	Gravelly sandy loam, loam, fine sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1-b	0-1	0-15	70-100	65-100	40-90	20-75	<25	NP-7
	13-37	Gravelly sandy loam, sandy loam, gravelly loamy sand.	SM, SC-SM, GM, GM-GC	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	35-80	12-45	<25	NP-7
	37-58	Gravelly sandy loam, sandy loam, fine sandy loam.	SM, SC, SC-SM, GM	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<30	NP-10
	58-60	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC-SM, GM, GM-GC	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<25	NP-7
NoB----------- Newood	0-4	Fine sandy loam.	SM, SC-SM	A-2, A-4	0	0-15	80-100	75-100	40-85	20-50	<25	NP-7
	4-13	Gravelly sandy loam, loam, fine sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1-b	0-1	0-15	70-100	65-100	40-90	20-75	<25	NP-7
	13-37	Gravelly sandy loam, sandy loam, gravelly loamy sand.	SM, SC-SM, GM, GM-GC	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	35-80	12-45	<25	NP-7
	37-58	Gravelly sandy loam, sandy loam, fine sandy loam.	SM, SC, SC-SM, GM	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<30	NP-10
	58-60	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC-SM, GM, GM-GC	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<25	NP-7
NpC:												
Newood-------	0-4	Sandy loam----	SM, SC-SM	A-2, A-4	0	0-15	80-100	75-100	40-85	20-50	<25	NP-7
	4-13	Gravelly sandy loam, loam, fine sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1-b	0-1	0-15	70-100	65-100	40-90	20-75	<25	NP-7
	13-37	Gravelly sandy loam, sandy loam, gravelly loamy sand.	SM, SC-SM, GM, GM-GC	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	35-80	12-45	<25	NP-7
	37-58	Gravelly sandy loam, sandy loam, fine sandy loam.	SM, SC, SC-SM, GM	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<30	NP-10
	58-60	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC-SM, GM, GM-GC	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<25	NP-7

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
NpC:												
Pence--------	0-4	Sandy loam----	SM, ML	A-4, A-2, A-1	0	0-15	85-100	75-100	45-85	20-55	<21	NP-4
	4-16	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0-4	0-15	55-100	45-100	30-95	15-75	<25	NP-7
	16-34	Gravelly sand, loamy sand, sand.	SM, SP-SM, GM, GP-GM	A-2, A-1, A-3	0-4	0-15	55-100	45-100	25-75	2-30	---	NP
	34-60	Gravelly coarse sand, sand, sand and gravel.	SP, SM	A-1, A-3, A-2	0-4	0-15	55-85	45-75	15-55	2-15	---	NP
NwD----------- Newot	0-2	Gravelly sandy loam.	SM, SC-SM	A-2, A-4, A-1-b	0	0-15	60-100	55-95	35-75	20-45	<25	NP-7
	2-5	Sandy loam, gravelly sandy loam, loam.	ML, CL-ML, SM, SC-SM	A-4, A-2, A-1-b	0	0-15	60-100	55-95	35-90	20-75	<25	NP-7
	5-16	Gravelly sandy loam, gravelly loam, sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	35-90	20-75	<25	NP-7
	16-27	Gravelly sandy loam, loam, gravelly loamy sand.	SM, SC-SM, GM, GM-GC	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	35-80	12-45	<25	NP-7
	27-57	Gravelly sandy loam, sandy loam, fine sandy loam.	SM, SC, SC-SM, GM	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<30	NP-9
	57-60	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC-SM, GM, GM-GC	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<30	NP-9
OsA----------- Ossmer	0-4	Silt loam-----	ML, CL-ML	A-4	0	0-9	95-100	90-100	70-100	65-85	18-25	3-7
	4-6	Silt loam-----	CL-ML, ML	A-4	0	0-9	95-100	90-100	70-100	65-85	<25	NP-7
	6-26	Silt loam-----	ML, CL, CL-ML	A-4	0-1	0-9	75-100	90-100	70-100	65-85	15-28	NP-9
	26-38	Loam, gravelly sandy loam.	SM, SC, CL, ML	A-2, A-1, A-4	0-3	0-9	55-100	50-100	30-95	15-80	<28	NP-9
	38-60	Stratified sand to very gravelly coarse sand.	SM, SP, GM, GP	A-1, A-3, A-2	0-3	0-9	30-100	25-100	7-70	1-25	---	NP

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
PaB----------- Padwet	0-2	Sandy loam----	SM	A-2, A-4, A-1-b	0	0-9	80-100	75-100	30-80	15-50	<20	NP-4
	2-30	Sandy loam, loam, fine sandy loam.	SM, SC, ML, CL	A-2, A-4, A-1-b	0	0-9	80-100	75-100	30-95	15-80	<25	NP-8
	30-39	Sandy loam, fine sandy loam, gravelly loam.	SM, SC, CL, ML	A-2, A-4, A-1	0	0-9	55-100	50-100	30-95	15-80	<30	NP-9
	39-60	Sand, very gravelly coarse sand.	SP, SM, GP, GM	A-1, A-2, A-3	0	0-9	30-100	25-95	7-65	1-25	---	NP
PbB, PbC------ Padwood	0-4	Sandy loam----	SM, SC-SM	A-2, A-4, A-1	0	0-9	80-100	75-100	45-80	20-50	<25	NP-7
	4-15	Sandy loam, loam, fine sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1	0	0-9	80-100	75-100	45-95	20-80	<25	NP-7
	15-27	Sandy loam, loam, gravelly fine sandy loam.	SM, SC-SM, ML, CL-ML	A-1, A-2, A-4	0-1	0-9	55-100	50-100	30-95	15-80	<25	NP-7
	27-36	Gravelly loamy sand, sand.	SM, SP, GM, GP	A-2, A-1, A-3	0-1	0-9	30-100	25-100	7-75	1-35	---	NP
	36-50	Sand, very gravelly coarse sand.	SP, SM, GP, GM	A-1, A-2, A-3	0-1	0-9	30-98	25-95	7-70	1-25	---	NP
	50-70	Stratified very fine sand to silt loam.	SM, SC-SM, ML, CL-ML	A-2, A-4	0	0	95-100	90-100	65-95	20-85	<25	NP-7
PcC:												
Pence--------	0-4	Loam----------	ML, CL-ML, SM, SC-SM	A-4	0	0-15	85-100	75-100	65-95	45-75	<25	2-6
	4-16	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0-4	0-15	55-100	45-100	30-95	15-75	<25	NP-7
	16-34	Gravelly sand, loamy sand, sand.	SM, SP-SM, GM, GP-GM	A-2, A-1, A-3	0-4	0-15	55-100	45-100	25-75	2-30	---	NP
	34-60	Gravelly coarse sand, sand, sand and gravel.	SP, SM	A-1, A-3, A-2	0-4	0-15	55-85	45-75	15-55	2-15	---	NP
Antigo-------	0-4	Silt loam-----	ML, CL-ML	A-4	0	0-3	95-100	90-100	70-100	65-85	<25	2-7
	4-17	Silt loam-----	ML, CL-ML	A-4	0	0-3	95-100	90-100	70-100	65-85	15-25	2-7
	17-21	Silt loam-----	CL, CL-ML	A-4	0	0-3	95-100	90-100	70-100	65-85	20-30	4-9
	21-31	Sandy loam, loam, gravelly loamy sand.	SM, GM, ML, GM-GC	A-2, A-4, A-1, A-3	0	0-9	50-100	45-100	25-95	7-75	<30	NP-9
	31-60	Coarse sand, sand, sand and gravel.	SP, SP-SM, GP, GP-GM	A-2, A-3, A-1	0	0-9	30-100	25-100	10-70	1-12	---	NP

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments >10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
PeB, PeC, PeD:												
Pence--------	0-4	Sandy loam----	SM, ML	A-4, A-2, A-1	0	0-15	85-100	75-100	45-85	20-55	<21	NP-4
	4-16	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0-4	0-15	55-100	45-100	30-95	15-75	<25	NP-7
	16-34	Gravelly loamy sand, loamy sand, sand.	SM, SP-SM, GM, GP-GM	A-2, A-1, A-3	0-4	0-15	55-100	45-100	25-75	2-30	---	NP
	34-60	Gravelly coarse sand, sand, sand and gravel.	SP, SM	A-1, A-3, A-2	0-4	0-15	55-85	45-75	15-55	2-15	---	NP
Padus--------	0-3	Sandy loam----	SM	A-2, A-4, A-1-b	0	0-9	55-100	50-100	30-90	15-50	<21	NP-4
	3-4	Sandy loam, fine sandy loam, loam.	ML, CL-ML, SM, SC-SM	A-4, A-2, A-1-b	0	0-9	55-100	50-100	30-95	15-80	<23	NP-6
	4-11	Sandy loam, loam, fine sandy loam.	SM, SC, ML, CL	A-2, A-4, A-1-b	0	0-9	55-100	50-100	30-95	15-80	<26	NP-8
	11-29	Sandy loam, gravelly loam, fine sandy loam.	SM, SC, ML, CL	A-2, A-4, A-1	0	0-9	55-100	50-100	30-95	15-80	<28	NP-9
	29-60	Gravelly coarse sand, sand.	SP, SP-SM, GP, GP-GM	A-1, A-2, A-3	0	0-9	30-100	25-95	7-65	1-25	---	NP
PsB----------- Pesabic	0-4	Fine sandy loam.	ML, CL-ML, SM, SC-SM	A-4, A-2	0	0-15	80-100	75-98	55-90	30-55	<25	NP-7
	4-5	Fine sandy loam, sandy loam, loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1	0-3	0-15	80-100	75-98	45-95	20-80	<25	NP-7
	5-13	Fine sandy loam, loam, sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1	0-3	0-15	80-100	75-98	40-95	20-80	<25	NP-7
	13-33	Fine sandy loam, sandy loam, gravelly loamy sand.	SM, SC, SC-SM	A-2, A-4, A-1	0-3	0-15	60-100	55-90	30-80	10-50	<28	NP-9
	33-53	Fine sandy loam, sandy loam, gravelly sandy loam.	SM, SC, SC-SM	A-2, A-4, A-1	0-3	0-15	60-100	55-90	35-80	15-50	<25	NP-10
	53-60	Fine sandy loam, sandy loam, gravelly sandy loam.	SM, SC-SM, SC	A-2, A-4, A-1	0-3	0-15	60-100	55-90	35-80	15-50	<28	NP-9
Pt. Pits												

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
SaC, SaD:												
Sarona-------	0-3	Sandy loam----	SM, SC-SM	A-2, A-4	0	0-15	80-100	75-98	55-90	30-55	<25	NP-7
	3-5	Fine sandy loam, sandy loam, loamy sand.	ML, CL-ML, SM, SP-SM	A-4, A-2, A-1	0	0-15	80-100	75-98	30-90	10-55	<23	NP-6
	5-18	Fine sandy loam, sandy loam, gravelly loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1	0-1	0-15	55-100	50-98	30-90	13-55	<23	NP-6
	18-77	Sandy loam, gravelly fine sandy loam.	SC, SM, SC-SM	A-2, A-1, A-4	0-2	0-15	55-100	50-98	30-90	12-45	<28	NP-9
	77-99	Loamy sand, sandy loam, gravelly sandy loam.	SM, SC-SM, SP-SM	A-2, A-1, A-4, A-3	0-2	0-15	55-100	50-98	20-75	7-45	<25	NP-7
Pence--------	0-4	Sandy loam----	SM, ML	A-4, A-2, A-1	0	0-15	85-100	75-100	45-85	20-55	<21	NP-4
	4-16	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0-4	0-15	55-100	45-100	30-95	15-75	<25	NP-7
	16-34	Gravelly coarse sand, loamy sand, sand.	SM, SP-SM, GM, GP-GM	A-2, A-1, A-3	0-4	0-15	55-100	45-100	25-75	2-30	---	NP
	34-60	Gravelly coarse sand, sand, sand and gravel.	SP, SM	A-1, A-3, A-2	0-4	0-15	55-85	45-75	15-55	2-15	---	NP
SbB----------- Sarwet	0-5	Sandy loam----	SM, SC-SM	A-2, A-4, A-1	0	0-25	55-100	50-98	30-90	15-50	<25	NP-7
	5-6	Sandy loam, gravelly fine sandy loam, loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1	0-1	0-25	55-100	50-98	30-95	15-80	<25	NP-7
	6-22	Sandy loam, fine sandy loam, gravelly loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1	0-1	0-25	55-100	50-98	30-95	15-80	<25	NP-7
	22-58	Sandy loam, gravelly loamy sand, fine sandy loam.	SM, SC-SM, SP-SM	A-2, A-1, A-4	0-3	0-25	55-100	50-98	20-90	7-50	<25	NP-7
	58-84	Gravelly sandy loam, fine sandy loam.	SM, SC-SM	A-2, A-1, A-4	0-5	0-25	55-100	50-98	30-90	15-50	<28	NP-9
	84-90	Gravelly sandy loam, loamy sand.	SM, SC-SM, SP-SM	A-2, A-4, A-1	0-5	0-25	55-100	50-98	20-80	7-50	<25	NP-7

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
ScB----------- Sconsin	0-4	Silt loam-----	ML, CL-ML	A-4	0	0-4	95-100	90-100	70-100	65-85	18-25	3-7
	4-27	Silt loam-----	ML, CL-ML	A-4	0	0-9	95-100	90-100	70-100	65-85	<25	NP-7
	27-34	Loam, gravelly sandy loam.	CL, ML, SM, SC	A-4, A-2, A-1-b	0	0-9	60-100	55-95	30-90	20-75	<28	NP-9
	34-38	Sandy loam, gravelly loam, gravelly loamy sand.	CL, ML, SM, SC	A-4, A-2, A-1-b	0	0-9	60-100	55-95	30-90	20-75	18-28	3-9
	38-60	Gravelly sand, loamy sand, very gravelly coarse sand.	GP, GM, SP, SM	A-2-4, A-3, A-1-a	0	0-9	40-90	30-85	7-60	1-30	---	NP
VsB, VsC, VsD: Vilas--------	0-3	Loamy sand----	SM, SP-SM	A-1, A-2	0	0	80-100	75-100	35-90	12-30	---	NP
	3-15	Loamy sand----	SP-SM, SM	A-1, A-2	0	0	80-100	75-100	35-90	12-30	---	NP
	15-30	Sand----------	SM, SP-SM	A-1, A-2, A-3	0	0	80-100	75-100	35-90	5-20	---	NP
	30-60	Sand----------	SP, SP-SM, SM	A-1, A-2, A-3	0	0	80-100	75-100	35-90	1-20	---	NP
Sayner-------	0-2	Loamy sand----	SM, SP-SM	A-1, A-2-4	0	0-15	80-100	75-100	30-75	10-35	---	NP
	2-5	Loamy sand, sand.	SM, SP-SM	A-2-4, A-3, A-1	0	0-15	80-100	75-100	20-75	5-35	---	NP
	5-19	Loamy sand, sand, gravelly sand.	SP, SP	A-1, A-3, A-2-4	0	0-15	50-100	50-100	15-75	2-35	---	NP
	19-32	Gravelly sand, loamy sand.	SM, SP	A-2-4, A-3, A-1	0-3	0-15	55-100	50-100	15-75	2-35	---	NP
	32-60	Stratified sand to gravel.	SP, SM	A-1, A-2-4	0-3	0-15	55-90	50-75	15-45	2-20	---	NP
WoA----------- Worcester	0-3	Sandy loam----	SM, SC	A-4, A-2-4	0	0-9	80-100	75-100	45-90	25-50	<26	NP-8
	3-16	Sandy loam, loam, gravelly fine sandy loam.	SM, SC	A-4, A-2-4, A-1-b	0	0-9	55-100	50-100	35-95	12-45	<26	NP-8
	16-32	Sandy loam, fine sandy loam, gravelly loam.	SM, SC	A-4, A-2-4, A-1-b	0	0-9	55-100	50-100	25-95	12-45	18-28	3-9
	32-39	Gravelly loamy sand, very gravelly coarse sand, sand.	SM, GM	A-2-4, A-3, A-1-a	0	0-9	30-100	25-100	10-75	5-35	<18	NP-3
	39-60	Gravelly sand, very gravelly coarse sand, sand.	SP, SM, GP, GM	A-3, A-1-a	0	0-9	30-100	25-100	7-70	1-25	---	NP

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
WsA----------- Worwood	0-3	Loam----------	SM, SC-SM	A-2, A-4, A-1	0	0-9	80-100	75-100	45-90	20-50	<25	NP-7
	3-11	Sandy loam, gravelly loam, fine sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1	0	0-9	55-100	50-100	45-95	20-80	<25	NP-7
	11-24	Sandy loam, gravelly loam, fine sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1	0-1	0-9	55-100	50-100	30-95	15-80	<25	NP-7
	24-34	Sandy loam, gravelly loam, fine sandy loam.	SM, SC, ML, CL	A-1, A-2, A-4	0-1	0-9	55-100	50-100	30-95	15-80	<28	NP-9
	34-42	Gravelly sand, coarse sand.	SP, SM, GP, GM	A-1, A-2, A-3	0-1	0-9	30-98	25-95	7-70	1-25	---	NP
	42-60	Stratified silt loam to sand.	SM, SC-SM, ML, CL-ML	A-2, A-4	0	0	95-100	90-100	65-95	20-85	<25	NP-7

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
AoB, AoC--------- Antigo	0-4	8-15	1.25-1.55	0.6-2.0	0.20-0.24	4.5-6.5	Low----------	0.37	4	5	1-3
	4-17	8-15	1.35-1.55	0.6-2.0	0.20-0.22	4.5-6.5	Low----------	0.43			
	17-21	8-17	1.55-1.65	0.6-2.0	0.16-0.22	4.5-6.5	Low----------	0.43			
	21-31	2-17	1.55-1.70	0.6-2.0	0.05-0.19	4.5-6.5	Low----------	0.24			
	31-60	1-6	1.50-1.70	>6.0	0.02-0.06	5.1-6.5	Low----------	0.10			
AuA-------------- Au Gres	0-5	10-15	1.30-1.55	6.0-20	0.07-0.09	3.6-7.3	Low----------	0.17	5	2	2-4
	5-21	1-15	1.50-1.70	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.12			
	21-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low----------	0.12			
AxA-------------- Augwood	0-1	1-6	1.35-1.65	6.0-20	0.08-0.12	3.6-6.0	Low----------	0.17	5	2	1-3
	1-3	1-3	1.35-1.65	6.0-20	0.05-0.09	3.6-6.0	Low----------	0.15			
	3-21	1-6	1.45-1.65	6.0-20	0.05-0.11	3.6-6.0	Low----------	0.17			
	21-55	0-3	1.45-1.70	6.0-20	0.04-0.07	4.5-6.5	Low----------	0.15			
	55-60	4-15	1.50-1.70	0.6-2.0	0.06-0.13	5.1-6.5	Low----------	0.20			
CoA-------------- Comstock	0-2	8-22	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	5	5	2-4
	2-16	8-20	1.40-1.65	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.43			
	16-36	18-30	1.40-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate-----	0.43			
	36-60	8-20	1.45-1.55	0.2-0.6	0.12-0.22	5.1-7.3	Low----------	0.37			
CpA:											
Comstock--------	0-2	8-22	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	5	5	2-4
	2-16	8-20	1.40-1.65	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.43			
	16-36	18-30	1.40-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate-----	0.43			
	36-60	8-20	1.45-1.55	0.2-0.6	0.12-0.22	5.1-7.3	Low----------	0.37			
Magnor----------	0-5	7-17	1.35-1.55	0.6-2.0	0.18-0.24	3.6-7.3	Low----------	0.37	5	5	1-3
	5-15	7-17	1.55-1.65	0.6-2.0	0.17-0.22	3.6-6.0	Low----------	0.43			
	15-25	7-17	1.55-1.65	0.6-2.0	0.17-0.22	3.6-6.0	Low----------	0.43			
	25-39	7-17	1.70-1.80	0.06-0.6	0.08-0.18	5.1-6.5	Low----------	0.20			
	39-60	3-14	1.80-1.95	<0.06	0-0.04	5.1-6.5	Low----------	0.28			
CrB-------------- Croswell	0-5	5-15	1.30-1.50	6.0-20	0.09-0.12	3.6-7.3	Low----------	0.17	5	2	.5-2
	5-31	0-10	1.40-1.60	6.0-20	0.06-0.10	4.5-7.3	Low----------	0.15			
	31-60	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-8.4	Low----------	0.15			
CsB-------------- Croswood	0-4	1-6	1.35-1.65	6.0-20	0.08-0.12	3.6-7.3	Low----------	0.17	5	2	1-3
	4-6	1-3	1.35-1.65	6.0-20	0.05-0.11	3.6-6.0	Low----------	0.15			
	6-22	1-6	1.45-1.65	6.0-20	0.05-0.11	3.6-6.0	Low----------	0.17			
	22-55	0-3	1.45-1.70	6.0-20	0.04-0.07	5.1-6.5	Low----------	0.15			
	55-80	4-15	1.50-1.70	0.6-2.0	0.06-0.13	5.1-6.5	Low----------	0.20			
CyB, CyC--------- Crystal Lake	0-11	8-20	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	5	5	2-4
	11-38	18-30	1.50-1.60	0.6-2.0	0.18-0.22	4.5-6.0	Moderate-----	0.37			
	38-60	6-20	1.45-1.55	0.2-0.6	0.20-0.22	4.5-7.3	Low----------	0.37			
Fh--------------- Fordum	0-9	10-23	1.35-1.45	0.6-2.0	0.17-0.24	4.5-8.4	Low----------	0.24	4	8	4-12
	9-31	8-17	1.40-1.50	0.6-6.0	0.10-0.22	4.5-8.4	Low----------	0.32			
	31-60	2-5	1.55-1.70	>6.0	0.04-0.10	5.6-8.4	Low----------	0.15			
FoB, FoC--------- Freeon	0-1	5-17	1.25-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	5	5	1-3
	1-20	5-17	1.30-1.60	0.6-2.0	0.18-0.22	4.5-7.3	Low----------	0.43			
	20-31	7-17	1.70-1.80	0.06-0.6	0.08-0.18	4.5-6.5	Low----------	0.28			
	31-42	3-14	1.70-1.80	0.06-0.6	0.08-0.18	4.5-6.5	Low----------	0.28			
	42-60	3-14	1.80-1.95	<0.06	0-0.04	5.1-7.3	Low----------	0.28			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
FsB:											
Freeon----------	0-1	5-17	1.25-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	5	5	1-3
	1-20	5-17	1.30-1.60	0.6-2.0	0.18-0.22	4.5-7.3	Low----------	0.43			
	20-31	7-17	1.70-1.80	0.06-0.6	0.08-0.18	4.5-6.5	Low----------	0.28			
	31-42	3-14	1.70-1.80	0.06-0.6	0.08-0.18	4.5-6.5	Low----------	0.28			
	42-60	3-14	1.80-1.95	<0.06	0-0.04	5.1-7.3	Low----------	0.28			
Sconsin---------	0-4	9-14	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	4	5	2-3
	4-27	5-14	1.40-1.60	0.6-2.0	0.20-0.22	4.5-6.5	Low----------	0.37			
	27-34	6-17	1.50-1.70	0.6-2.0	0.05-0.19	4.5-6.5	Low----------	0.32			
	34-38	8-17	1.50-1.70	0.6-2.0	0.05-0.19	4.5-6.5	Low----------	0.24			
	38-60	1-5	1.55-1.80	>6.0	0.01-0.09	5.1-6.5	Low----------	0.10			
GoC-------------- Goodman	0-5	5-12	1.35-1.45	0.6-2.0	0.19-0.24	3.6-6.5	Low----------	0.37	5	5	2-4
	5-6	4-10	1.45-1.60	0.6-2.0	0.18-0.24	3.6-6.5	Low----------	0.37			
	6-15	8-14	1.45-1.60	0.6-2.0	0.17-0.22	3.6-6.5	Low----------	0.37			
	15-24	8-14	1.50-1.60	0.6-2.0	0.17-0.22	3.6-6.5	Low----------	0.43			
	24-50	2-12	1.50-1.70	0.6-2.0	0.05-0.18	3.6-6.5	Low----------	0.24			
	50-60	2-12	1.50-1.75	0.6-2.0	0.05-0.16	5.1-6.5	Low----------	0.28			
GwB-------------- Goodwit	0-2	5-12	1.35-1.45	0.6-2.0	0.19-0.24	4.5-7.3	Low----------	0.37	5	5	2-4
	2-3	4-10	1.45-1.60	0.6-2.0	0.18-0.22	4.5-7.3	Low----------	0.37			
	3-15	6-14	1.45-1.60	0.6-2.0	0.17-0.22	4.5-6.0	Low----------	0.37			
	15-30	2-10	1.50-1.70	0.6-2.0	0.05-0.18	4.5-6.5	Low----------	0.24			
	30-50	4-14	1.50-1.70	0.6-2.0	0.07-0.18	4.5-6.5	Low----------	0.24			
	50-60	2-12	1.50-1.75	0.6-2.0	0.05-0.12	5.1-6.5	Low----------	0.28			
HyB-------------- Hatley	0-3	12-16	1.35-1.55	0.6-2.0	0.16-0.24	4.5-7.3	Low----------	0.37	5	5	2-4
	3-6	3-12	1.50-1.65	0.6-2.0	0.13-0.22	4.5-6.5	Low----------	0.37			
	6-14	4-15	1.50-1.65	0.6-2.0	0.13-0.22	4.5-6.5	Low----------	0.43			
	14-46	5-17	1.55-1.65	0.6-2.0	0.08-0.19	4.5-6.5	Low----------	0.32			
	46-60	4-10	1.55-1.70	0.6-6.0	0.04-0.12	4.5-7.3	Low----------	0.17			
KwC, KwD--------- Keweenaw	0-4	2-15	1.35-1.70	0.6-2.0	0.13-0.15	4.5-6.5	Low----------	0.24	5	3	1-2
	4-20	2-15	1.45-1.80	2.0-6.0	0.08-0.11	4.5-6.5	Low----------	0.17			
	20-43	0-15	1.50-1.80	2.0-6.0	0.05-0.11	4.5-6.5	Low----------	0.17			
	43-60	0-15	1.50-1.80	0.6-6.0	0.06-0.14	4.5-6.5	Low----------	0.17			
Lo:											
Loxley----------	0-20	---	0.30-0.40	2.0-6.0	0.35-0.65	<4.5	-------------	0.10	5	7	70-90
	20-60	---	0.10-0.35	0.2-6.0	0.35-0.45	<4.5	-------------	0.10			
Dawson----------	0-8	---	0.15-0.30	2.0-6.0	0.55-0.65	3.6-4.4	-------------	0.10	4	7	65-85
	8-40	---	0.15-0.40	0.2-6.0	0.35-0.45	3.6-4.4	-------------	0.10			
	40-60	0-10	1.55-1.75	6.0-20	0.03-0.10	4.5-6.5	Low----------	0.08			
Lu:											
Lupton----------	0-24	---	0.10-0.35	0.2-6.0	0.35-0.45	5.6-7.8	-------------	0.10	5	2	70-90
	24-60	---	0.10-0.35	0.2-6.0	0.35-0.45	5.6-7.8	-------------	0.10			
Cathro----------	0-15	---	0.28-0.45	0.2-6.0	0.45-0.55	4.5-7.8	-------------	0.10	5	2	60-85
	15-28	---	0.15-0.30	0.2-6.0	0.35-0.45	4.5-7.8	-------------	0.10			
	28-60	10-30	1.50-1.70	0.2-2.0	0.11-0.22	5.6-8.4	Low----------	0.32			
Markey----------	0-36	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	-------------	0.10	4	2	55-85
	36-60	0-10	1.40-1.65	6.0-20	0.03-0.08	5.6-8.4	Low----------	0.15			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
MaB---------------- Magnor	0-5	7-17	1.35-1.55	0.6-2.0	0.18-0.24	3.6-7.3	Low-----------	0.37	5	5	1-3
	5-15	7-17	1.55-1.65	0.6-2.0	0.17-0.22	3.6-6.0	Low-----------	0.43			
	15-25	7-17	1.55-1.65	0.6-2.0	0.17-0.22	3.6-6.0	Low-----------	0.43			
	25-39	7-17	1.70-1.80	0.06-0.6	0.08-0.18	5.1-6.5	Low-----------	0.20			
	39-60	3-14	1.80-1.95	<0.06	0-0.04	5.1-6.5	Low-----------	0.28			
MgB:											
Magnor------------	0-5	7-17	1.35-1.55	0.6-2.0	0.18-0.24	3.6-7.3	Low-----------	0.37	5	5	1-3
	5-15	7-17	1.55-1.65	0.6-2.0	0.17-0.22	3.6-6.0	Low-----------	0.43			
	15-25	7-17	1.55-1.65	0.6-2.0	0.17-0.22	3.6-6.0	Low-----------	0.43			
	25-39	7-17	1.70-1.80	0.06-0.6	0.08-0.18	5.1-6.5	Low-----------	0.20			
	39-60	3-14	1.80-1.95	<0.06	0-0.04	5.1-6.5	Low-----------	0.28			
Ossmer------------	0-4	8-15	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low-----------	0.37	4	5	2-3
	4-6	5-14	1.40-1.60	0.6-2.0	0.20-0.22	4.5-6.5	Low-----------	0.37			
	6-26	7-17	1.40-1.65	0.6-2.0	0.20-0.22	4.5-6.5	Low-----------	0.37			
	26-38	7-17	1.40-1.70	0.6-2.0	0.06-0.19	4.5-6.5	Low-----------	0.32			
	38-60	1-6	1.50-1.80	>6.0	0.01-0.07	5.1-6.5	Low-----------	0.10			
MkB---------------- Magroc	0-4	5-17	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low-----------	0.37	5	5	1-3
	4-21	5-17	1.55-1.65	0.6-2.0	0.18-0.22	4.5-6.5	Low-----------	0.37			
	21-42	7-17	1.40-1.70	0.6-2.0	0.08-0.18	4.5-6.5	Low-----------	0.32			
	42-46	---	---	0.01-20	---	---	--------------	----			
MoB, MoC---------- Mequithy	0-4	5-15	1.35-1.55	0.6-2.0	0.17-0.24	4.5-6.5	Low-----------	0.37	4	5	2-4
	4-19	5-15	1.55-1.65	0.6-2.0	0.12-0.22	4.5-6.5	Low-----------	0.32			
	19-38	6-18	1.40-1.70	0.6-2.0	0.08-0.19	4.5-6.5	Low-----------	0.24			
	38-42	---	---	0.01-20	---	---	--------------	----			
Ms:											
Minocqua---------	0-4	---	0.15-0.45	0.6-2.0	0.35-0.45	4.5-7.8	Low-----------	0.10	4	2	30-60
	4-33	10-17	1.50-1.60	0.6-2.0	0.11-0.19	4.5-7.8	Low-----------	0.43			
	33-37	3-10	1.65-1.75	2.0-20	0.06-0.13	4.5-7.8	Low-----------	0.10			
	37-60	0-3	1.75-1.85	>6.0	0.02-0.04	4.5-7.8	Low-----------	0.10			
Capitola---------	0-5	---	0.15-0.35	0.6-2.0	0.35-0.45	4.5-7.3	Low-----------	0.10	5	2	50-80
	5-7	12-16	1.25-1.45	0.2-2.0	0.16-0.24	4.5-7.3	Low-----------	0.37			
	7-22	8-17	1.35-1.60	0.2-2.0	0.09-0.22	4.5-7.3	Low-----------	0.43			
	22-33	8-16	1.40-1.90	0.2-2.0	0.07-0.16	4.5-7.3	Low-----------	0.28			
	33-60	5-10	1.70-1.90	0.2-0.6	0.05-0.16	5.1-7.8	Low-----------	0.28			
MxB---------------- Moodig	0-3	4-15	1.35-1.70	0.6-2.0	0.09-0.15	3.6-7.3	Low-----------	0.24	5	3	2-4
	3-5	4-15	1.40-1.70	0.6-2.0	0.09-0.15	3.6-5.5	Low-----------	0.24			
	5-22	4-15	1.40-1.70	0.6-2.0	0.09-0.18	3.6-5.5	Low-----------	0.24			
	22-53	4-17	1.40-1.70	0.6-2.0	0.07-0.18	3.6-5.5	Low-----------	0.24			
	53-73	5-17	1.40-1.70	0.6-2.0	0.07-0.18	5.1-6.5	Low-----------	0.17			
	73-95	4-12	1.40-1.70	0.6-6.0	0.05-0.14	5.1-6.5	Low-----------	0.20			
NeC, NoB---------- Newood	0-4	2-15	1.35-1.70	0.6-2.0	0.12-0.18	4.5-6.5	Low-----------	0.24	5	3	1-3
	4-13	2-15	1.40-1.70	0.6-2.0	0.09-0.19	4.5-6.5	Low-----------	0.17			
	13-37	4-17	1.40-1.70	0.6-2.0	0.06-0.17	4.5-6.5	Low-----------	0.20			
	37-58	10-17	1.80-2.05	0.06-0.2	0.08-0.10	4.5-6.5	Low-----------	0.20			
	58-60	7-17	1.80-2.05	<0.06	0-0.04	5.1-6.5	Low-----------	0.28			
NpC:											
Newood------------	0-4	2-15	1.35-1.70	0.6-2.0	0.12-0.18	4.5-6.5	Low-----------	0.24	5	3	1-3
	4-13	2-15	1.40-1.70	0.6-2.0	0.09-0.19	4.5-6.5	Low-----------	0.17			
	13-37	4-17	1.40-1.70	0.6-2.0	0.06-0.17	4.5-6.5	Low-----------	0.20			
	37-58	10-17	1.80-2.05	0.06-0.2	0.08-0.10	4.5-6.5	Low-----------	0.20			
	58-60	7-17	1.80-2.05	<0.06	0-0.04	5.1-6.5	Low-----------	0.28			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
NpC:											
Pence------------	0-4	3-11	1.20-1.65	2.0-6.0	0.10-0.18	4.5-6.5	Low-----------	0.24	3	3	1-3
	4-16	2-12	1.35-1.45	2.0-6.0	0.10-0.15	4.5-6.0	Low-----------	0.24			
	16-34	2-10	1.65-1.75	2.0-20	0.05-0.08	4.5-6.5	Low-----------	0.10			
	34-60	0-4	1.35-1.80	>6.0	0.02-0.05	5.1-6.5	Low-----------	0.10			
NwD--------------- Newot	0-2	2-15	1.35-1.70	0.6-2.0	0.12-0.18	3.6-7.3	Low-----------	0.24	5	3	1-3
	2-5	2-15	1.40-1.70	0.6-2.0	0.09-0.19	3.6-5.5	Low-----------	0.24			
	5-16	2-15	1.40-1.70	0.6-2.0	0.09-0.19	4.5-5.5	Low-----------	0.20			
	16-27	4-17	1.40-1.70	0.6-2.0	0.06-0.17	4.5-6.0	Low-----------	0.20			
	27-57	10-17	1.80-2.05	0.06-0.2	0.08-0.10	5.1-6.5	Low-----------	0.20			
	57-60	7-17	1.80-2.05	<0.06	0-0.04	5.1-6.5	Low-----------	0.28			
OsA--------------- Ossmer	0-4	8-15	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low-----------	0.37	4	5	2-3
	4-6	5-14	1.40-1.60	0.6-2.0	0.20-0.22	4.5-6.5	Low-----------	0.37			
	6-26	7-17	1.40-1.65	0.6-2.0	0.20-0.22	4.5-6.5	Low-----------	0.37			
	26-38	7-17	1.40-1.70	0.6-2.0	0.06-0.19	4.5-6.5	Low-----------	0.32			
	38-60	1-6	1.50-1.80	>6.0	0.01-0.07	5.1-6.5	Low-----------	0.10			
PaB--------------- Padwet	0-2	3-10	1.35-1.70	0.6-2.0	0.10-0.15	4.5-7.3	Low-----------	0.24	4	3	2-3
	2-30	5-15	1.40-1.65	0.6-2.0	0.09-0.19	4.5-6.5	Low-----------	0.24			
	30-39	6-17	1.40-1.65	0.6-2.0	0.06-0.19	5.1-6.5	Low-----------	0.24			
	39-60	0-3	1.55-1.80	>6.0	0.01-0.06	5.1-6.5	Low-----------	0.15			
PbB, PbC---------- Padwood	0-4	3-15	1.35-1.70	0.6-2.0	0.10-0.18	4.5-7.3	Low-----------	0.24	4	3	2-3
	4-15	3-15	1.40-1.70	0.6-2.0	0.09-0.19	4.5-6.0	Low-----------	0.24			
	15-27	3-15	1.40-1.70	0.6-2.0	0.06-0.19	4.5-6.5	Low-----------	0.24			
	27-36	2-5	1.40-1.70	>6.0	0.02-0.11	4.5-6.5	Low-----------	0.10			
	36-50	0-3	1.50-1.80	>6.0	0.01-0.08	5.1-6.5	Low-----------	0.10			
	50-70	5-15	1.40-1.80	0.2-0.6	0.10-0.18	5.1-6.5	Low-----------	0.32			
PcC:											
Pence------------	0-4	7-12	1.20-1.55	2.0-6.0	0.16-0.22	4.5-6.5	Low-----------	0.32	3	5	1-3
	4-16	2-12	1.35-1.45	2.0-6.0	0.10-0.15	4.5-6.0	Low-----------	0.24			
	16-34	2-10	1.65-1.75	2.0-20	0.05-0.08	4.5-6.5	Low-----------	0.10			
	34-60	0-4	1.35-1.80	>6.0	0.02-0.05	5.1-6.5	Low-----------	0.10			
Antigo-----------	0-4	8-15	1.25-1.55	0.6-2.0	0.20-0.24	4.5-6.5	Low-----------	0.37	4	5	1-3
	4-17	8-15	1.35-1.55	0.6-2.0	0.20-0.22	4.5-6.5	Low-----------	0.43			
	17-21	8-17	1.55-1.65	0.6-2.0	0.16-0.22	4.5-6.5	Low-----------	0.43			
	21-31	2-17	1.55-1.70	0.6-2.0	0.05-0.19	4.5-6.5	Low-----------	0.24			
	31-60	1-6	1.50-1.70	>6.0	0.02-0.06	5.1-6.5	Low-----------	0.10			
PeB, PeC, PeD:											
Pence------------	0-4	3-11	1.20-1.65	2.0-6.0	0.10-0.18	4.5-6.5	Low-----------	0.24	3	3	1-3
	4-16	2-12	1.35-1.45	2.0-6.0	0.10-0.15	4.5-6.0	Low-----------	0.24			
	16-34	2-10	1.65-1.75	2.0-20	0.05-0.08	4.5-6.5	Low-----------	0.10			
	34-60	0-4	1.35-1.80	>6.0	0.02-0.05	5.1-6.5	Low-----------	0.10			
Padus------------	0-3	3-10	1.35-1.70	0.6-2.0	0.10-0.18	4.5-7.3	Low-----------	0.24	4	3	1-3
	3-4	3-12	1.40-1.70	0.6-2.0	0.09-0.19	4.5-6.5	Low-----------	0.24			
	4-11	6-15	1.40-1.70	0.6-2.0	0.09-0.19	4.5-6.5	Low-----------	0.24			
	11-29	6-18	1.40-1.70	0.6-2.0	0.06-0.19	4.5-6.5	Low-----------	0.24			
	29-60	0-3	1.55-1.80	>6.0	0.01-0.06	5.1-6.5	Low-----------	0.10			
PsB--------------- Pesabic	0-4	2-15	1.35-1.65	0.6-2.0	0.14-0.18	4.5-6.5	Low-----------	0.24	5	3	2-4
	4-5	2-15	1.35-1.70	0.6-2.0	0.12-0.19	4.5-6.5	Low-----------	0.24			
	5-13	4-17	1.40-1.70	0.6-2.0	0.08-0.19	4.5-6.5	Low-----------	0.24			
	13-33	4-17	1.40-1.70	0.6-2.0	0.06-0.17	4.5-6.5	Low-----------	0.28			
	33-53	10-20	1.80-2.05	0.06-0.2	0.08-0.10	4.5-6.5	Low-----------	0.28			
	53-60	4-17	1.80-2.05	<0.06	0.	5.1-6.5	Low-----------	0.28			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Pt. Pits											
SaC, SaD: Sarona----------	0-3	3-15	1.35-1.65	0.6-2.0	0.10-0.18	4.5-7.3	Low----------	0.24	5	3	1-3
	3-5	3-12	1.45-1.65	0.6-2.0	0.08-0.18	4.5-6.5	Low----------	0.24			
	5-18	3-12	1.55-1.65	0.6-2.0	0.05-0.17	4.5-6.5	Low----------	0.24			
	18-77	3-17	1.60-1.70	0.6-2.0	0.07-0.17	4.5-6.5	Low----------	0.24			
	77-99	1-15	1.60-1.70	0.6-6.0	0.04-0.13	5.1-6.5	Low----------	0.17			
Pence-----------	0-4	3-11	1.20-1.65	2.0-6.0	0.10-0.18	4.5-6.5	Low----------	0.24	3	3	1-3
	4-16	2-12	1.35-1.45	2.0-6.0	0.10-0.15	4.5-6.0	Low----------	0.24			
	16-34	2-10	1.65-1.75	2.0-20	0.05-0.08	4.5-6.5	Low----------	0.10			
	34-60	0-4	1.35-1.80	>6.0	0.02-0.05	5.1-6.5	Low----------	0.10			
SbB-------------- Sarwet	0-5	4-15	1.35-1.65	0.6-2.0	0.08-0.18	4.5-7.3	Low----------	0.24	5	3	2-3
	5-6	4-15	1.55-1.65	0.6-2.0	0.08-0.19	3.6-6.0	Low----------	0.24			
	6-22	4-15	1.55-1.65	0.6-2.0	0.08-0.19	4.5-6.0	Low----------	0.24			
	22-58	4-15	1.60-1.80	0.6-2.0	0.06-0.17	5.1-6.0	Low----------	0.24			
	58-84	5-17	1.60-1.80	0.6-2.0	0.08-0.17	5.1-6.5	Low----------	0.17			
	84-90	4-15	1.60-1.80	0.6-2.0	0.05-0.13	5.1-6.5	Low----------	0.20			
ScB-------------- Sconsin	0-4	9-14	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	4	5	2-3
	4-27	5-14	1.40-1.60	0.6-2.0	0.20-0.22	4.5-6.5	Low----------	0.37			
	27-34	6-17	1.50-1.70	0.6-2.0	0.05-0.19	4.5-6.5	Low----------	0.32			
	34-38	8-17	1.50-1.70	0.6-2.0	0.05-0.19	4.5-6.5	Low----------	0.24			
	38-60	1-5	1.55-1.80	>6.0	0.01-0.09	5.1-6.5	Low----------	0.10			
VsB, VsC, VsD: Vilas-----------	0-3	2-6	1.35-1.65	6.0-20	0.09-0.12	4.5-6.5	Low----------	0.17	5	2	<1
	3-15	2-6	1.50-1.65	6.0-20	0.07-0.12	4.5-6.5	Low----------	0.17			
	15-30	1-3	1.50-1.70	6.0-20	0.05-0.08	4.5-6.5	Low----------	0.17			
	30-60	0-3	1.50-1.70	6.0-20	0.04-0.07	5.1-6.5	Low----------	0.17			
Sayner----------	0-2	1-5	1.25-1.45	2.0-6.0	0.08-0.12	4.5-6.5	Low----------	0.17	4	2	.5-2
	2-5	1-5	1.35-1.55	2.0-20	0.04-0.11	4.5-6.5	Low----------	0.17			
	5-19	0-5	1.35-1.65	2.0-20	0.03-0.11	4.5-6.5	Low----------	0.17			
	19-32	0-4	1.45-1.70	2.0-20	0.03-0.11	4.5-6.5	Low----------	0.10			
	32-60	0-3	1.55-1.80	>6.0	0.01-0.03	5.1-6.5	Low----------	0.10			
WoA-------------- Worcester	0-3	5-15	1.35-1.70	0.6-2.0	0.10-0.18	4.5-6.5	Low----------	0.24	4	3	1-3
	3-16	5-15	1.40-1.70	0.6-2.0	0.06-0.19	4.5-6.5	Low----------	0.24			
	16-32	8-17	1.40-1.70	0.6-2.0	0.06-0.19	4.5-6.5	Low----------	0.24			
	32-39	3-8	1.45-1.70	>6.0	0.02-0.11	4.5-6.5	Low----------	0.10			
	39-60	0-3	1.50-1.80	>6.0	0.01-0.07	5.1-6.5	Low----------	0.10			
WsA-------------- Worwood	0-3	3-15	1.35-1.70	0.6-2.0	0.10-0.18	4.5-7.3	Low----------	0.32	4	5	2-3
	3-11	3-15	1.40-1.70	0.6-2.0	0.09-0.19	4.5-6.5	Low----------	0.24			
	11-24	3-15	1.40-1.70	0.6-2.0	0.06-0.19	4.5-6.5	Low----------	0.24			
	24-34	5-17	1.40-1.70	0.6-2.0	0.06-0.19	4.5-6.5	Low----------	0.24			
	34-42	0-3	1.50-1.80	>6.0	0.01-0.08	5.1-6.5	Low----------	0.10			
	42-60	5-15	1.40-1.80	0.2-0.6	0.10-0.18	5.1-6.5	Low----------	0.32			

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "frequent," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Total subsi-dence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness			Uncoated steel	Concrete
					Ft			In		In			
AoB, AoC-------- Antigo	B	None--------	---	---	>6.0	---	---	>60	---	---	High-----	Moderate	High.
AuA------------- Au Gres	B	None--------	---	---	0.5-1.5	Apparent	Nov-May	>60	---	---	Moderate	Low------	Moderate.
AxA------------- Augwood	B	None--------	---	---	0.5-2.0	Perched	Sep-Jun	>60	---	---	Moderate	Low------	High.
CoA------------- Comstock	C	None--------	---	---	1.0-3.0	Perched	Sep-Jun	>60	---	---	High-----	Moderate	High.
CpA:													
Comstock-------	C	None--------	---	---	1.0-3.0	Perched	Sep-Jun	>60	---	---	High-----	Moderate	High.
Magnor---------	C	None--------	---	---	1.0-3.0	Perched	Sep-Jun	>60	---	---	High-----	Low------	Moderate.
CrB------------- Croswell	A	None--------	---	---	2.5-3.5	Apparent	Nov-May	>60	---	---	Low------	Low------	Moderate.
CsB------------- Croswood	A	None--------	---	---	2.5-3.5	Perched	Sep-Jun	>60	---	---	Low------	Low------	High.
CyB, CyC-------- Crystal Lake	B	None--------	---	---	2.5-3.5	Perched	Sep-Jun	>60	---	---	High-----	Low------	High.
Fh-------------- Fordum	D	Frequent----	Brief or long.	Mar-Jun	+1-1.0	Apparent	Jan-Dec	>60	---	---	High-----	High-----	High.
FoB, FoC-------- Freeon	C	None--------	---	---	2.0-3.5	Perched	Nov-May	>60	---	---	Moderate	Low------	Moderate.
FsB:													
Freeon---------	C	None--------	---	---	2.0-3.5	Perched	Nov-May	>60	---	---	Moderate	Low------	Moderate.
Sconsin--------	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	High.
GoC------------- Goodman	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	High.
GwB------------- Goodwit	B	None--------	---	---	2.5-3.5	Perched	Sep-Jun	>60	---	---	Moderate	Low------	High.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Total subsi-dence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness			Uncoated steel	Concrete
					Ft			In		In			
HyB------------- Hatley	C	None--------	---	---	1.0-3.0	Apparent	Oct-Jun	>60	---	---	High-----	Low------	High.
KwC, KwD-------- Keweenaw	A	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Moderate.
Lo:													
Loxley---------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	>60	---	50-55	High-----	High-----	High.
Dawson---------	A/D	None--------	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	30-36	High-----	High-----	High.
Lu:													
Lupton---------	A/D	None--------	---	---	+1-1.0	Apparent	Sep-May	>60	---	50-55	High-----	High-----	Low.
Cathro---------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	19-22	High-----	High-----	Low.
Markey---------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	25-30	High-----	High-----	Low.
MaB------------- Magnor	C	None--------	---	---	1.0-3.0	Perched	Sep-Jun	>60	---	---	High-----	Low------	Moderate.
MgB:													
Magnor---------	C	None--------	---	---	1.0-3.0	Perched	Sep-Jun	>60	---	---	High-----	Low------	Moderate.
Ossmer---------	C	None--------	---	---	1.0-3.0	Apparent	Oct-Jun	>60	---	---	High-----	Moderate	Moderate.
MkB------------- Magroc	C	None--------	---	---	1.0-3.0	Perched	Sep-Jun	40-60	Hard	---	High-----	Moderate	Moderate.
MoB, MoC-------- Mequithy	B	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Low------	High.
Ms:													
Minocqua-------	B/D	None--------	---	---	+1-1.0	Apparent	Oct-Jun	>60	---	---	High-----	High-----	High.
Capitola-------	B/D	None--------	---	---	+1-1.0	Apparent	Oct-Jun	>60	---	---	High-----	High-----	High.
MxB------------- Moodig	C	None--------	---	---	0.5-2.0	Perched	Sep-Jun	>60	---	---	High-----	Moderate	High.
NeC, NoB-------- Newood	C	None--------	---	---	2.5-3.5	Perched	May-Jun	>60	---	---	Moderate	Moderate	High.
NpC:													
Newood---------	C	None--------	---	---	2.5-3.5	Perched	May-Jun	>60	---	---	Moderate	Moderate	High.
Pence----------	B	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Moderate.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Total subsi-dence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness			Uncoated steel	Concrete
					Ft			In		In			
NwD------------- Newot	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	High.
OsA------------- Ossmer	C	None---------	---	---	1.0-3.0	Apparent	Oct-Jun	>60	---	---	High-----	Moderate	Moderate.
PaB------------- Padwet	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate	High.
PbB, PbC-------- Padwood	B	None---------	---	---	2.5-3.5	Perched	Sep-Jun	>60	---	---	Moderate	Moderate	High.
PcC:													
Pence----------	B	None---------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Moderate.
Antigo---------	B	None---------	---	---	>6.0	---	---	>60	---	---	High-----	Moderate	High.
PeB, PeC, PeD:													
Pence----------	B	None---------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Moderate.
Padus----------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	Moderate.
PsB------------- Pesabic	C	None---------	---	---	0.5-2.0	Perched	Oct-Jun	>60	---	---	High-----	Moderate	High.
Pt. Pits													
SaC, SaD:													
Sarona---------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	Moderate.
Pence----------	B	None---------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Moderate.
SbB------------- Sarwet	B	None---------	---	---	2.5-3.5	Perched	Sep-Jun	>60	---	---	Moderate	Moderate	High.
ScB------------- Sconsin	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	High.
VsB, VsC, VsD:													
Vilas----------	A	None---------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	High.
Sayner---------	A	None---------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Moderate.
WoA------------- Worcester	C	None---------	---	---	0.5-2.0	Apparent	Oct-May	>60	---	---	High-----	High-----	High.
WsA------------- Worwood	C	None---------	---	---	0.5-2.0	Perched	Sep-Jun	>60	---	---	High-----	High-----	High.

TABLE 19.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available. HO means horizon; LL, liquid limit; PI, plasticity index; UN, Unified; and NP, nonplastic)

Soil name and location	Parent material	Report number	Depth	HO	Percentage passing sieve*-- No. 4	No. 10	No. 40	No. 200	Percentage smaller than*-- 0.05 mm	0.02 mm	0.005 mm	0.002 mm	LL	PI	Classification AASHTO	UN
			In										Pct			
Crystal Lake	Dominantly	S85WI-069-														
loam:	silty	76-1	12-18	E/B	100	100	96	81	71	47	21	12	22.0	3.8	A-4(8)	ML
SW1/4NW1/4 sec.	lacustrine	76-2	24-29	Bt	100	100	99	93	89	67	36	25	36.2	15.5	A-6(10)	CL
3, T. 32 N.,	deposits.	76-3	39-102	C1	100	100	99	92	83	50	23	26	27.0	7.8	A-4(8)	CL
R. 7 E.																
Crystal Lake	Dominantly	S85WI-069-														
loam:	silty	80-1	11-17	B/E	100	100	100	98	93	67	33	23	32.4	11.8	A-6(9)	CL
NE1/4SW1/4 sec.	lacustrine	80-2	17-26	Bt1	100	100	100	98	95	72	39	26	36.4	14.9	A-6(10)	CL
32, T. 33 N.,	deposits.	80-3	38-65	BC	100	100	100	96	89	60	27	17	27.2	8.1	A-4(8)	CL
R. 7 E.		80-4	65-96	C1	100	100	100	78	62	25	10	7	18.7	NP	A-4(8)	ML
Crystal Lake	Dominantly	S85WI-069-														
loam:	silty	82-1	23-48	Bt	100	100	100	97	87	60	30	22	25.2	8.0	A-4(8)	CL
NW1/4SW1/4 sec.	lacustrine															
32, T. 33 N.,	deposits.															
R. 7 E.																
Freeon silt loam:	Silty	S85WI-069-														
NW1/4NW1/4 sec.	deposits and	55-1	31-42	2Bt	87	83	73	40	35	24	15	11	17.8	4.0	A-4(1)	SM
36, T. 31 N.,	the under-	55-2	42-60	2Cd	92	88	77	42	36	25	17	12	19.0	4.8	A-4(1)	SM
R. 4 E.	lying dense,															
	loamy															
	glacial															
	till.															
Goodman silt	Silty	S87WI-069-														
loam:	deposits and	221-1	15-24	2E/B	87	82	70	41	35	21	8	5	16.6	NP	A-4(1)	SM
SW1/4SW1/4 sec.	the under-	221-2	31-34	2Bt1	75	69	55	23	19	11	5	3	---	NP	A-2-4(0)	SM
35, T. 34 N.,	lying	221-3	50-60	2C	86	83	69	20	16	9	5	4	---	NP	A-2-4(0)	SM
R. 7 E.	friable,															
	loamy															
	glacial															
	till.															
Keweenaw sandy	Dominantly	S88WI-069-														
loam:	sandy	228-5	24-41	E/B	86	83	68	17	13	7	3	2	---	NP	A-2-4(0)	SM
NE1/4SW1/4 sec.	glacial	228-7	60-74	Bt1	90	86	72	20	17	12	8	6	---	NP	A-2-4(0)	SM
13, T. 34 N.,	drift.	228-9	97-119	C	88	85	68	15	13	8	5	3	---	NP	A-2-4(0)	SM
R. 7 E.																

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name and location	Parent material	Report number	Depth	HO	Percentage passing sieve*-- No. 4	No. 10	No. 40	No. 200	Percentage smaller than*-- 0.05 mm	0.02 mm	0.005 mm	0.002 mm	LL	PI	Classification AASHTO	UN
			In										Pct			
Keweenaw sandy	Dominantly	S86WI-069-														
loam:	sandy	132-1	16-28	Bs3	87	83	69	18	14	7	2	1	13.9	NP	A-2-4(0)	SM
SW1/4SE1/4 sec.	glacial	132-2	28-54	E/B	90	87	73	19	15	8	4	2	11.5	NP	A-2-4(0)	SM
17, T. 34 N.,	drift.	132-3	65-85	B/E2	90	87	69	16	13	9	6	4	---	NP	A-2-4(0)	SM
R. 8 E.		132-4	85-115	C	92	89	72	17	14	10	6	5	---	NP	A-2-4(0)	SM
Keweenaw sandy	Dominantly	S86WI-069-														
loam:	sandy	138-1	27-43	E/B	82	79	66	16	13	6	2	1	---	NP	A-2-4(0)	SM
SW1/4NW1/4 sec.	glacial	138-2	43-54	B/E	90	88	76	21	15	7	4	3	---	NP	A-2-4(0)	SM
18, T. 34 N.,	drift.	138-3	75-100	C	88	84	72	19	14	8	5	3	---	NP	A-2-4(0)	SM
R. 8 E.																
Mequithy loam:	Silty and	S90WI-069-														
NW1/4NE1/4 sec.	loamy	225-4	13-19	E/B	99	98	91	64	59	36	13	7	18.0	NP	A-4(6)	ML
33, T. 31 N.,	deposits and	225-5	19-28	B/E	100	100	96	70	64	45	17	11	20.9	1.6	A-4(7)	ML
R. 7 E.	loamy	225-6	28-38	Bt	98	98	90	51	46	29	13	10	18.6	2.8	A-4(3)	ML
	glacial															
	drift.															
Moodig sandy	Dominantly	S90WI-069-														
loam:	friable,	256-5	12-21	E/B	92	90	78	32	29	18	8	6	15.2	NP	A-2-4(0)	SM
NE1/4NE1/4 sec.	loamy	256-6	21-32	B/E	94	91	77	31	25	15	7	5	15.4	NP	A-2-4(0)	SM
4, T. 35 N.,	glacial	256-8	37-60	C	84	78	60	25	20	11	4	2	12.2	NP	A-2-4(0)	SM
R. 5 E.	till.															
Newood sandy	Dominantly	S88WI-069-														
loam:	dense, loamy	226-6	17-32	E/B	78	74	59	26	21	14	7	4	---	NP	A-2-4(0)	SM
NE1/4NE1/4 sec.	glacial	226-7	32-41	Bt1	80	73	60	24	23	19	13	9	20.7	5.8	A-2-4(0)	SC
27, T. 32 N.,	till.	226-9	57-72	Cd	74	69	56	26	21	15	9	6	16.8	NP	A-2-4(0)	SM
R. 5 E.																
Newood sandy	Dominantly	S85WI-069-														
loam:	dense, loamy	058-5	14-28	E/B	85	80	66	31	26	16	6	4	51.5	NP	A-2-5(0)	SM
NW1/4SE1/4 sec.	glacial	058-7	34-45	2Bt	86	82	67	30	26	18	10	6	15.0	NP	A-2-4(0)	SM
13, T. 32 N.,	till.															
R. 7 E.																
Newood sandy	Dominantly	S82WI-069-														
loam:	dense, loamy	3-2&3	2-21	Bs1,2	75	70	55	22	17	9	4	2	---	NP	A-2-4(0)	SM
SE1/4SW1/4 sec.	glacial	3-4&5	21-38	E/B,												
20, T. 32 N.,	till.			B/E	83	78	63	24	19	11	4	2	---	NP	A-2-4(0)	SM
R. 6 E.		3-6&7	38-52	Bt1,2	82	78	63	26	23	15	8	6	---	NP	A-2-4(0)	SM
		3-8	52-60	Cd	85	79	66	28	23	14	7	5	---	NP	A-2-4(0)	SM

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name and location	Parent material	Report number	Depth	HO	Percentage passing sieve*-- No. 4	No. 10	No. 40	No. 200	Percentage smaller than*-- 0.05 mm	0.02 mm	0.005 mm	0.002 mm	LL	PI	Classification AASHTO	UN
			In										Pct			
Pence sandy loam: NE1/4NW1/4 sec. 3, T. 32 N., R. 7 E.	Loamy deposits and the underlying sand and gravel.	S86WI-069-														
		149-1	12-19	Bs	59	48	34	9	7	5	3	2	---	NP	A-1-b(0)	SM-SP
		149-2	30-45	C1	62	43	16	2	1	1	1	1	---	NP	A-1-a(0)	SP
Pesabic fine sandy loam: NW1/4SW1/4 sec. 31, T. 32 N., R. 6 E.	Dominantly dense, loamy glacial till.	S87WI-069-														
		210-5	13-23	E/B	91	87	73	37	30	17	5	4	---	NP	A-4(0)	SM
		210-7	33-44	Bt1	88	84	66	26	24	18	12	10	19.6	4.0	A-2-4(0)	SM
		210-9	55-60	Cd	86	82	68	35	29	19	10	7	17.1	2.6	A-4(0)	SM
Sarona sandy loam: NE1/4NE1/4 sec. 8, T. 32 N., R. 7 E.	Dominantly friable, loamy glacial till.	S88WI-069-														
		227-5	25-42	E/B	68	64	53	20	15	8	3	2	---	NP	A-2-4(0)	SM
		227-7	60-68	Bt1	70	65	54	21	17	10	4	3	---	NP	A-2-4(0)	SM
		227-9	85-95	C	74	70	57	21	15	8	3	1	---	NP	A-2-4(0)	SM
Sarona sandy loam: NW1/4NE1/4 sec. 35, T. 33 N., R. 7 E.	Dominantly friable, loamy glacial till.	S86WI-069-														
		135-1	36-49	B/E	82	78	65	24	20	11	5	4	12.0	NP	A-2-4(0)	SM

* Mechanical analysis according to the AASHTO Designation T88-57. Results from this procedure can differ somewhat from those obtained by the soil survey procedure of the Natural Resources Conservation Service. In the AASHTO procedure, the fine material is analyzed by hydrometer method and the various grain-size fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the Natural Resources Conservation Service soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from the calculation of grain-size fraction. The mechanical analysis data used in this table are not suitable for use in naming textural classes of soils.

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Antigo	Coarse-loamy over sandy or sandy-skeletal, mixed Typic Glossoboralfs
Au Gres	Sandy, mixed, frigid Typic Endoaquods
Augwood	Sandy, mixed, frigid Typic Epiaquods
Capitola	Coarse-loamy, mixed, frigid Mollic Epiaqualfs
Cathro	Loamy, mixed, euic Terric Borosaprists
Comstock	Fine-silty, mixed Aquic Glossoboralfs
Croswell	Sandy, mixed, frigid Oxyaquic Haplorthods
Croswood	Sandy, mixed, frigid Oxyaquic Haplorthods
Crystal Lake	Fine-silty, mixed Oxyaquic Glossoboralfs
Dawson	Sandy or sandy-skeletal, mixed, dysic Terric Borosaprists
Fordum	Coarse-loamy, mixed, nonacid, frigid Mollic Fluvaquents
Freeon	Coarse-loamy, mixed Oxyaquic Glossoboralfs
Goodman	Coarse-loamy, mixed, frigid Alfic Haplorthods
Goodwit	Coarse-loamy, mixed, frigid Oxyaquic Haplorthods
Hatley	Coarse-loamy, mixed Aquic Glossoboralfs
Keweenaw	Sandy, mixed, frigid Alfic Haplorthods
Loxley	Dysic Typic Borosaprists
Lupton	Euic Typic Borosaprists
Magnor	Coarse-loamy, mixed Aquic Glossoboralfs
Magroc	Coarse-loamy, mixed Aquic Glossoboralfs
Markey	Sandy or sandy-skeletal, mixed, euic Terric Borosaprists
Mequithy	Coarse-loamy, mixed, frigid Alfic Haplorthods
Minocqua	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, frigid Typic Endoaquepts
Moodig	Coarse-loamy, mixed, frigid Alfic Epiaquods
Newood	Coarse-loamy, mixed, frigid Oxyaquic Haplorthods
Newot	Coarse-loamy, mixed, frigid Alfic Haplorthods
Ossmer	Coarse-loamy over sandy or sandy-skeletal, mixed Aquic Glossoboralfs
Padus	Coarse-loamy, mixed, frigid Alfic Haplorthods
Padwet	Coarse-loamy, mixed, frigid Alfic Haplorthods
Padwood	Coarse-loamy, mixed, frigid Oxyaquic Haplorthods
Pence	Sandy, mixed, frigid Entic Haplorthods
Pesabic	Coarse-loamy, mixed, frigid Alfic Epiaquods
Sarona	Coarse-loamy, mixed, frigid Alfic Haplorthods
Sarwet	Coarse-loamy, mixed, frigid Oxyaquic Haplorthods
Sayner	Sandy, mixed, frigid Entic Haplorthods
Sconsin	Coarse-loamy over sandy or sandy-skeletal, mixed Typic Glossoboralfs
Vilas	Sandy, mixed, frigid Entic Haplorthods
Worcester	Coarse-loamy, mixed, frigid Argic Endoaquods
Worwood	Coarse-loamy, mixed, frigid Alfic Epiaquods

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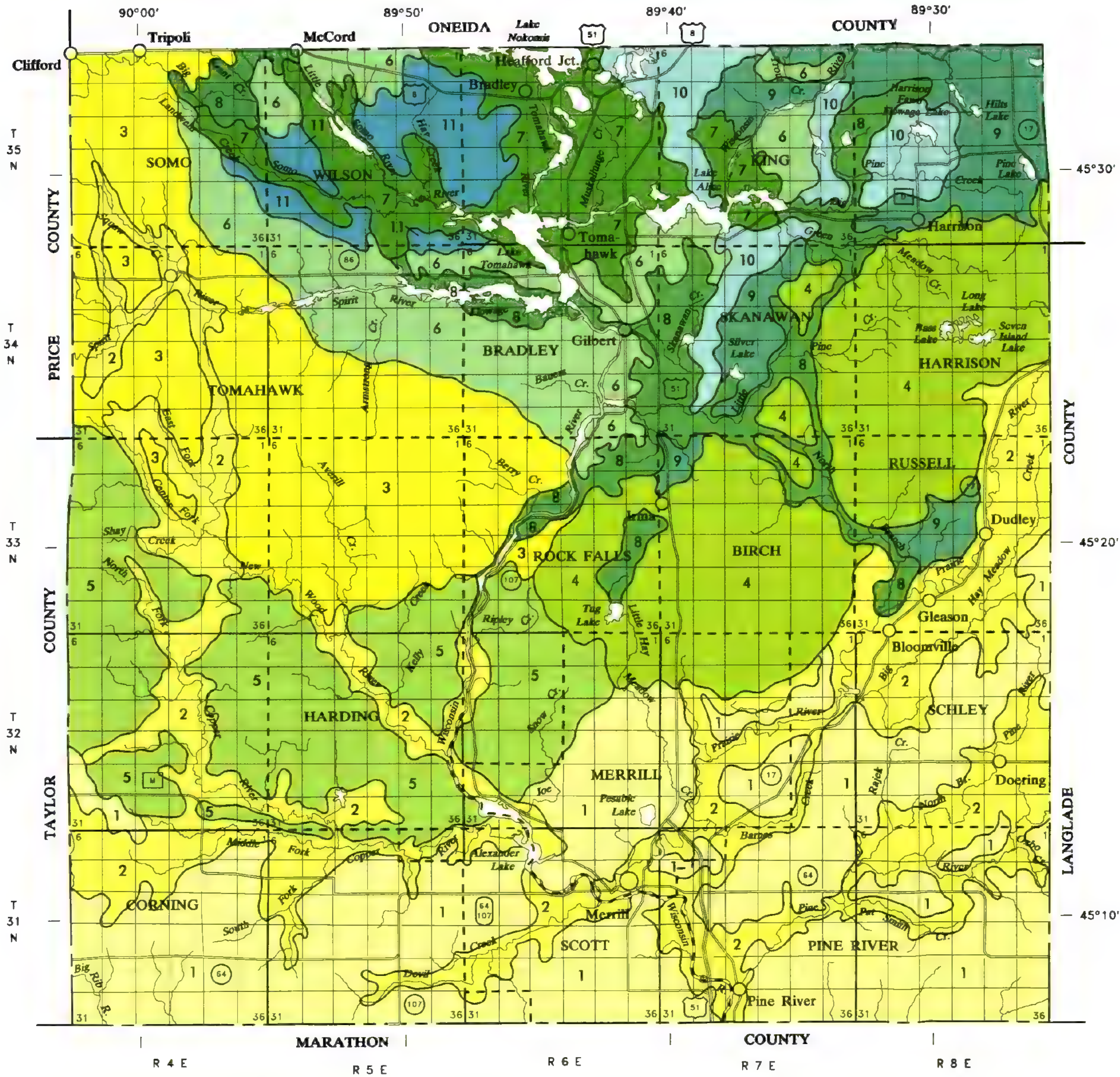


SOIL LEGEND *

1	MAGNOR–FREEON–CAPITOLA ASSOCIATION
2	OSSMER–MINOCQUA–SCONSIN ASSOCIATION
3	MAGNOR–LUPTON–CAPITOLA ASSOCIATION
4	SARONA–KEWEENAW–GOODMAN ASSOCIATION
5	NEWOOD–MAGNOR–FREEON ASSOCIATION
6	SARWET–MOODIG–LUPTON ASSOCIATION
7	VILAS–CROSWELL–MARKEY ASSOCIATION
8	LUPTON–PADWET–MINOCQUA ASSOCIATION
9	PENCE–PADUS–ANTIGO ASSOCIATION
10	VILAS–SAYNER–KEWEENAW ASSOCIATION
11	CROSWOOD–LUPTON–AUGWOOD ASSOCIATION

*The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1993

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
RESEARCH DIVISION OF THE COLLEGE
OF AGRICULTURAL AND LIFE SCIENCES
UNIVERSITY OF WISCONSIN

GENERAL SOIL MAP

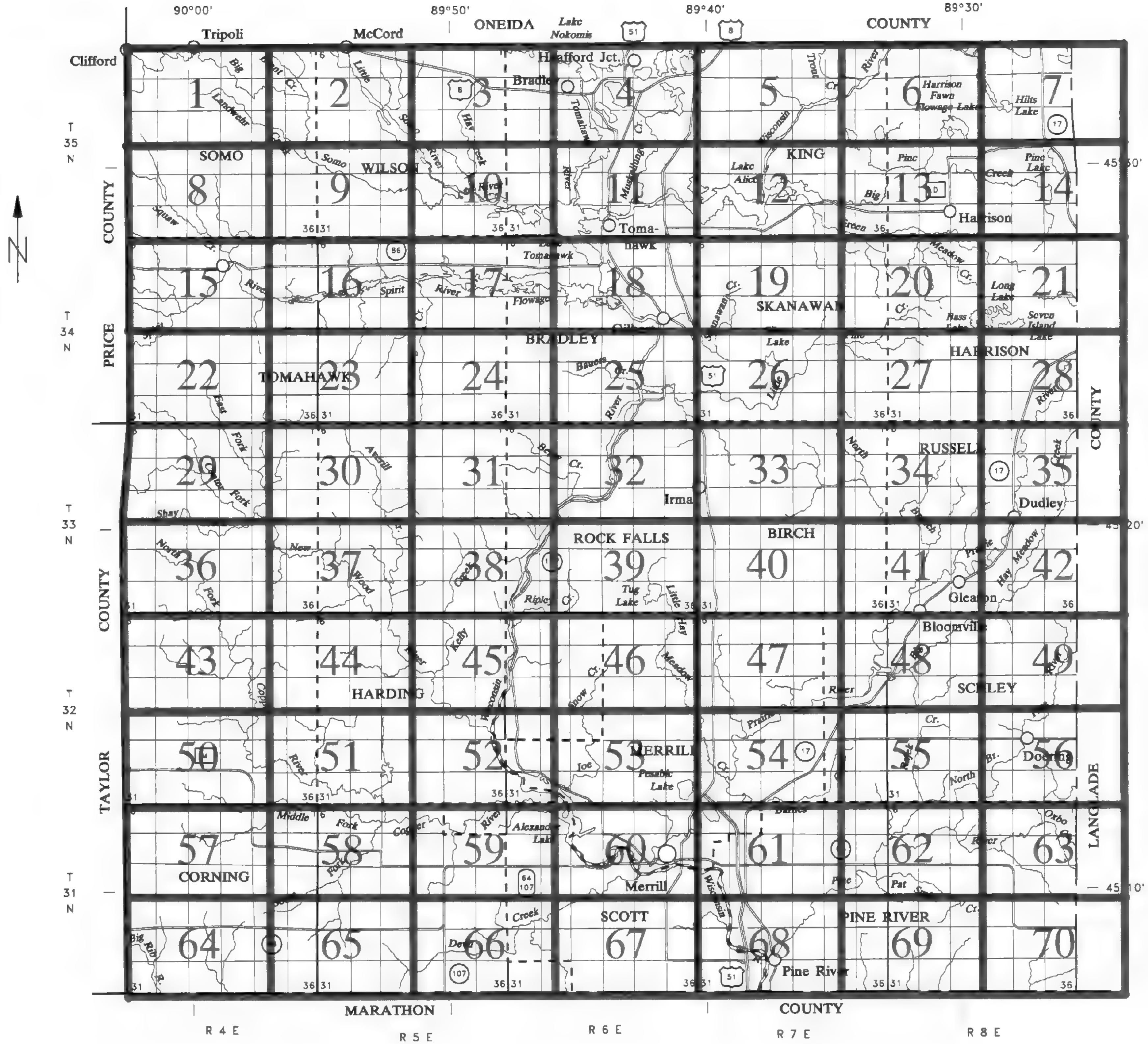
LINCOLN COUNTY, WISCONSIN

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



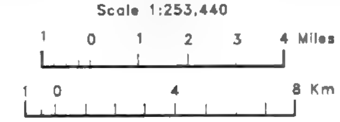
SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

LINCOLN COUNTY, WISCONSIN

Scale 1:253,440



SOIL LEGEND

Map symbols consist of a combination of upper case and lower case letters. The first letter in the map symbol is upper case and is the initial letter of the map unit name. The second letter in the map symbol is lower case and separates map units having names that begin with the same letter, except that it does not separate slope phases. Some map symbols have a third letter which is upper case and indicates the class of slope. Map symbols without a third letter for slope are for nearly level soils or for miscellaneous areas.

SYMBOL	NAME
AoB	Antigo silt loam, 1 to 6 percent slopes
AoC	Antigo silt loam, 6 to 15 percent slopes
AuA	Au Gres loamy sand, 0 to 3 percent slopes
AwA	Augwood loamy sand, 0 to 3 percent slopes
CoA	Comstock silt loam, 0 to 3 percent slopes
CpA	Comstock-Magnor silt loams, 0 to 3 percent slopes
CrB	Croswell loamy sand, 1 to 6 percent slopes
CsB	Croswood loamy sand, 1 to 6 percent slopes
CyB	Crystal Lake silt loam, 1 to 6 percent slopes
CyC	Crystal Lake silt loam, 6 to 15 percent slopes
Fh	Fordum loam, 0 to 2 percent slopes
FoB	Freeon silt loam, 2 to 6 percent slopes
FoC	Freeon silt loam, 6 to 15 percent slopes
FsB	Freeon-Sconsin silt loams, 2 to 6 percent slopes
GoC	Goodman silt loam, 6 to 15 percent slopes
GwB	Goodwit silt loam, 2 to 6 percent slopes
HyB	Hatley silt loam, 0 to 4 percent slopes
KwC	Keweenaw sandy loam, 6 to 15 percent slopes
KwD	Keweenaw sandy loam, 15 to 35 percent slopes
Lo	Loxley and Dawson peats, 0 to 1 percent slopes
Lu	Lupton, Cathro, and Markey mucks, 0 to 1 percent slopes
MaB	Magnor silt loam, 0 to 4 percent slopes
MgB	Magnor-Ossmer silt loams, 0 to 4 percent slopes
MkB	Magroc silt loam, 0 to 4 percent slopes
MoB	Mequithy silt loam, 2 to 6 percent slopes
MoC	Mequithy silt loam, 6 to 15 percent slopes
Ms	Minocqua and Capitola mucks, 0 to 2 percent slopes
MxB	Moodig sandy loam, 0 to 4 percent slopes
NeC	Newood sandy loam, 6 to 15 percent slopes
NoB	Newood fine sandy loam, 2 to 6 percent slopes
NpC	Newood-Pence sandy loams, 6 to 15 percent slopes
NwD	Newot gravelly sandy loam, 15 to 35 percent slopes
OsA	Ossmer silt loam, 0 to 3 percent slopes
PaB	Padwet sandy loam, 1 to 6 percent slopes
PbB	Padwood sandy loam, 1 to 6 percent slopes
PbC	Padwood sandy loam, 6 to 15 percent slopes
PcC	Pence-Antigo complex, 6 to 15 percent slopes
PeB	Pence-Padus sandy loams, 1 to 6 percent slopes
PeC	Pence-Padus sandy loams, 6 to 15 percent slopes
PeD	Pence-Padus sandy loams, 15 to 35 percent slopes
PsB	Pesabic fine sandy loam, 0 to 4 percent slopes
Pt	Pits, gravel
SaC	Sarona-Pence sandy loams, 6 to 15 percent slopes
SaD	Sarona-Pence sandy loams, 15 to 35 percent slopes
SbB	Sarwet sandy loam, 2 to 6 percent slopes
ScB	Sconsin silt loam, 1 to 6 percent slopes
VsB	Vilas-Sayner loamy sands, 1 to 6 percent slopes
VsC	Vilas-Sayner loamy sands, 6 to 15 percent slopes
VsD	Vilas-Sayner loamy sands, 15 to 35 percent slopes
WoA	Worcester sandy loam, 0 to 3 percent slopes
WsA	Worwood loam, 0 to 3 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County
- State park
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Airport, park, golf course, cemetery, fairground, etc...

STATE COORDINATE TICK 1 890 000 FEET

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided Highway
- Good motor road

ROAD EMBLEM & DESIGNATIONS

- Federal — 81
- State — 17
- County — E

RAILROAD

DAMS

- Medium or Small — water

PITS

- Gravel pit (1-5 acres)
- Mine or quarry (1-5 acres)

MISCELLANEOUS CULTURAL FEATURES

- House
- Church
- School

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Drainage ditches

SMALL LAKES, PONDS AND RESERVOIRS

- Perennial water (2-5 acres)

MISCELLANEOUS WATER FEATURES

- Spring (< 5 acres)

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — FoC FoB MaB W

ESCARPMENTS

- Bedrock (points down slope)

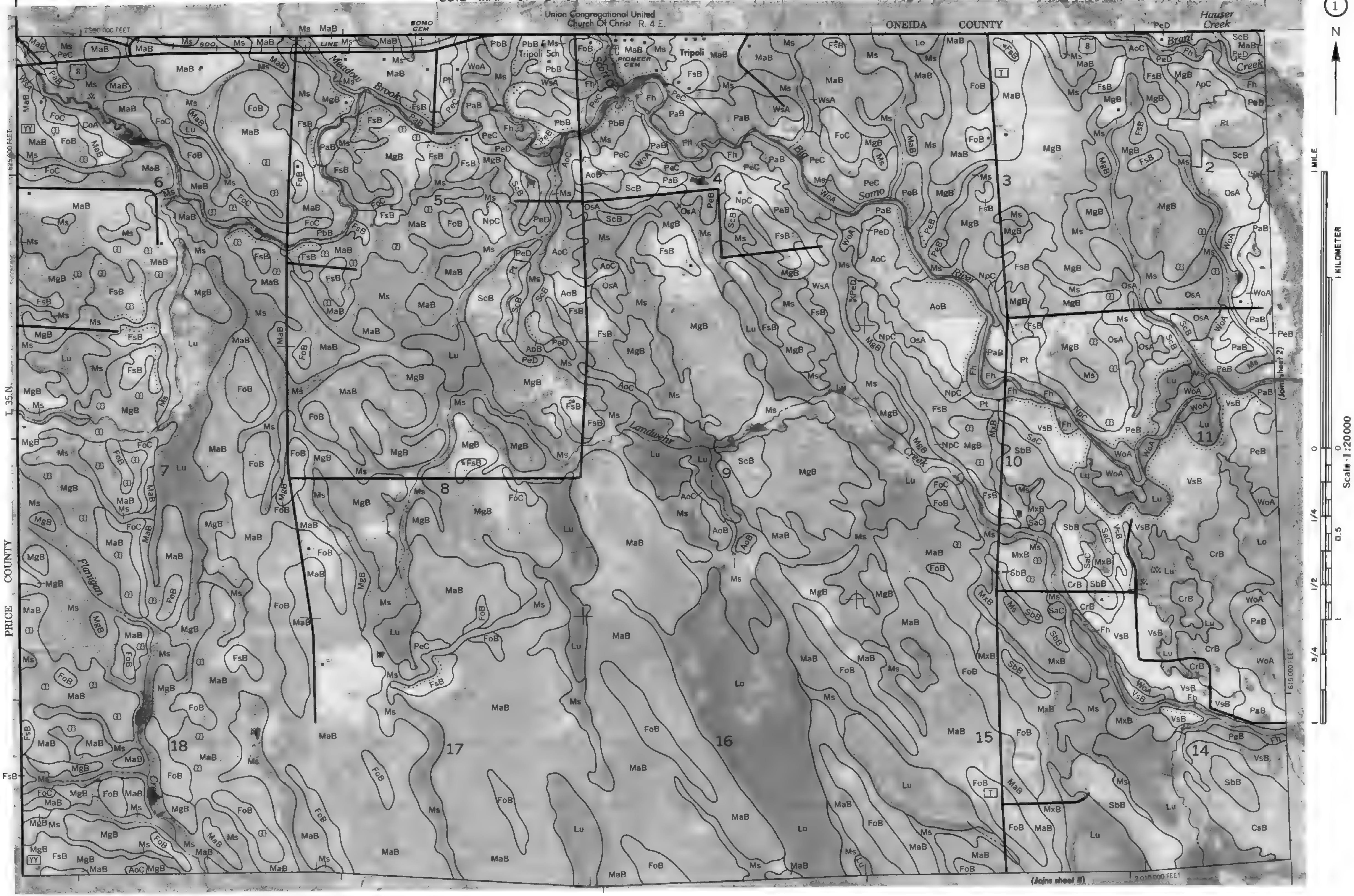
SHORT STEEP SLOPE

DEPRESSION, closed (1-5 acres)

MISCELLANEOUS

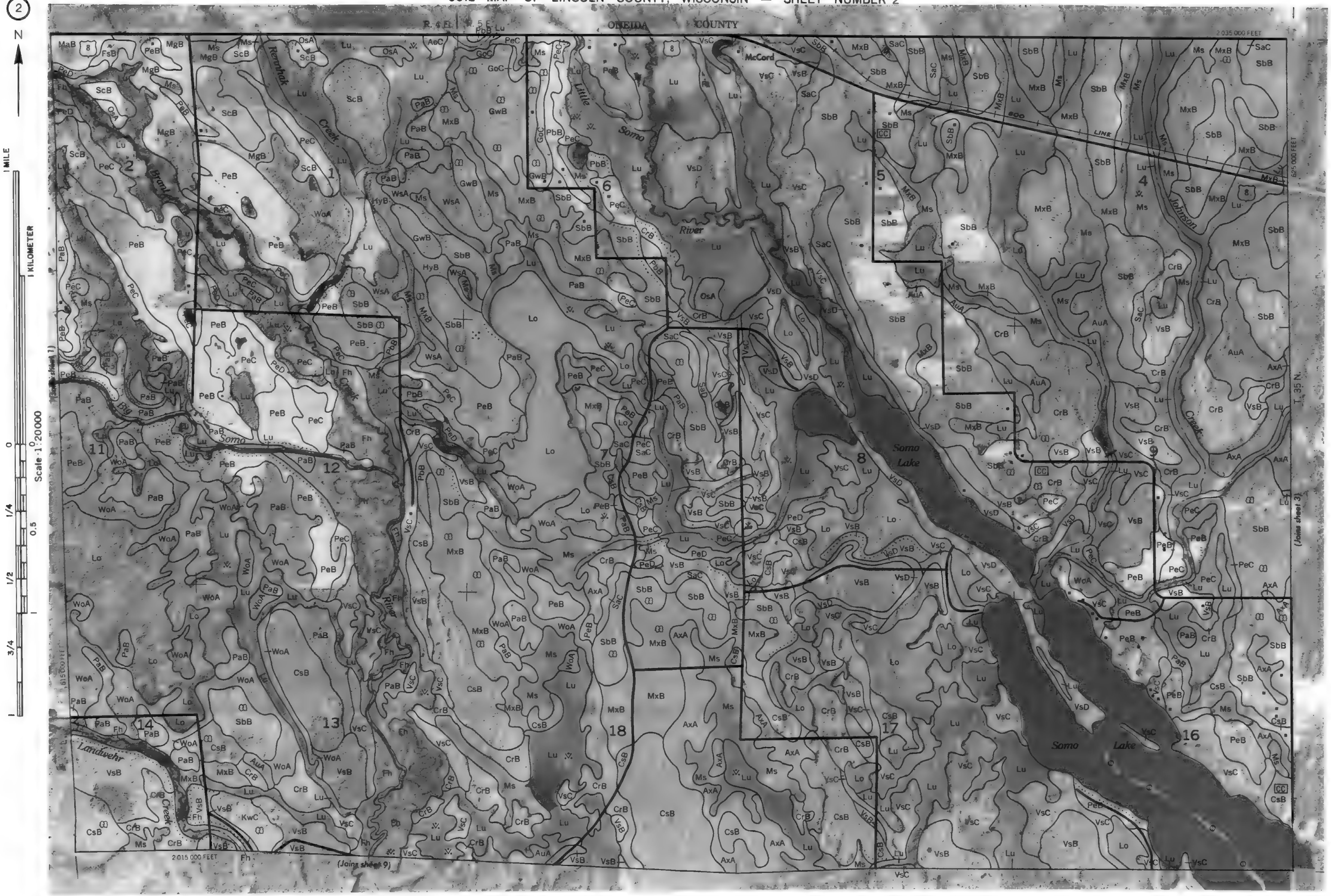
- Very stony spot (1-5 acres)
- Rock outcrop (1/2-5 acres)
- Sandy spot (1-5 acres)
- Landfill
- Fill area (1-5 acres)
- Soil spot (1/2-5 acres)
- Dry spot (1/2-5 acres)

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 1



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 2



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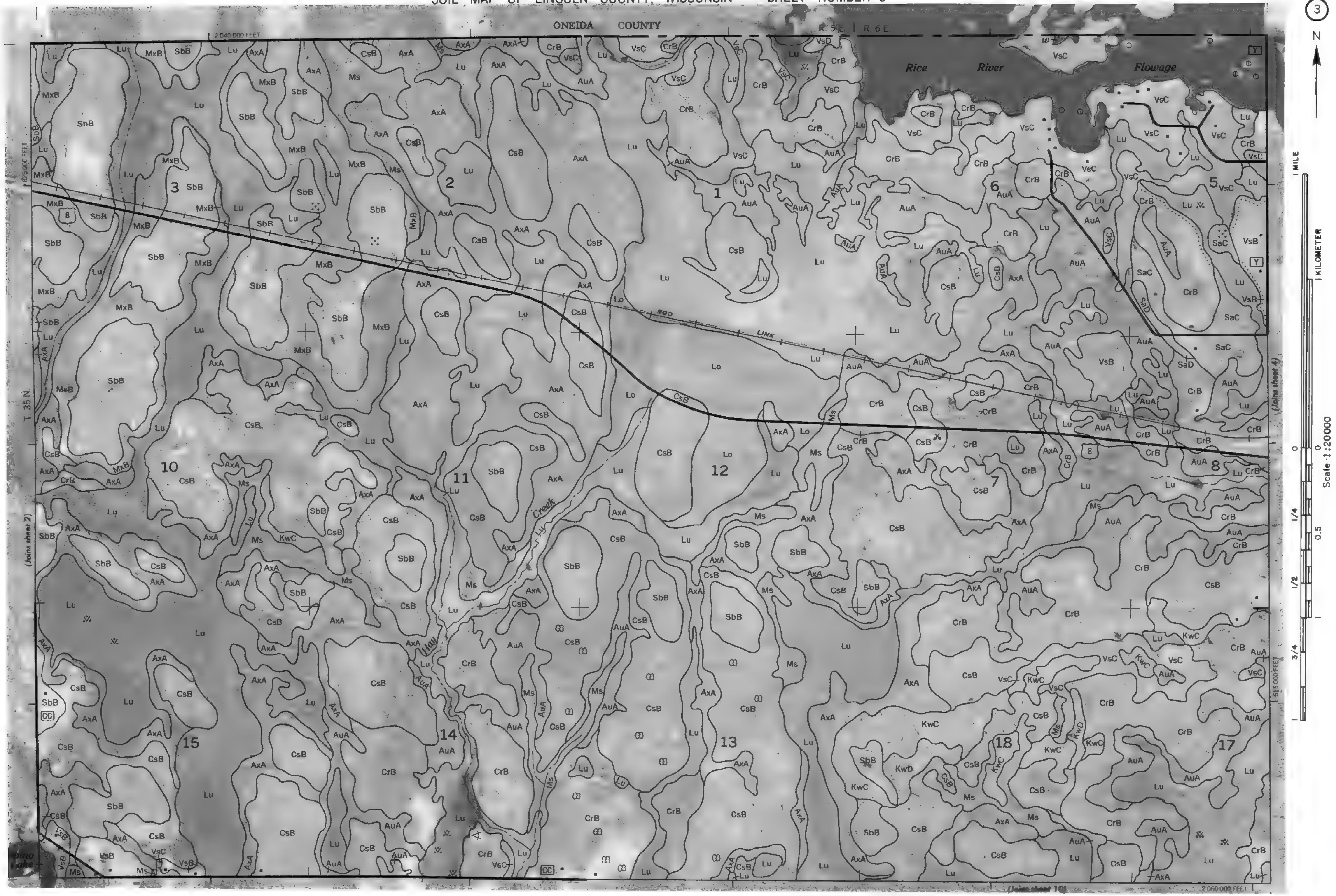
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 3



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SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 4

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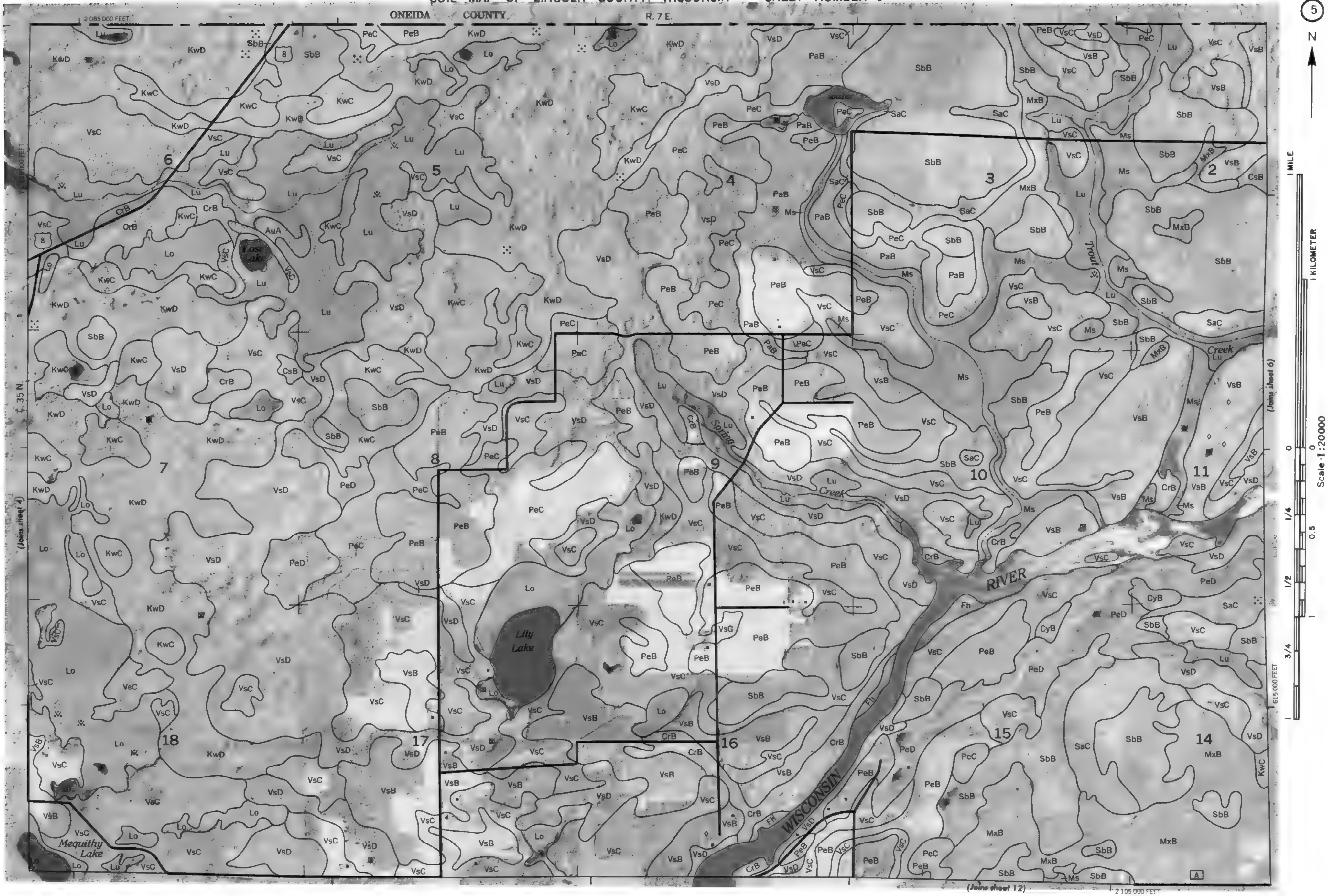
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 5



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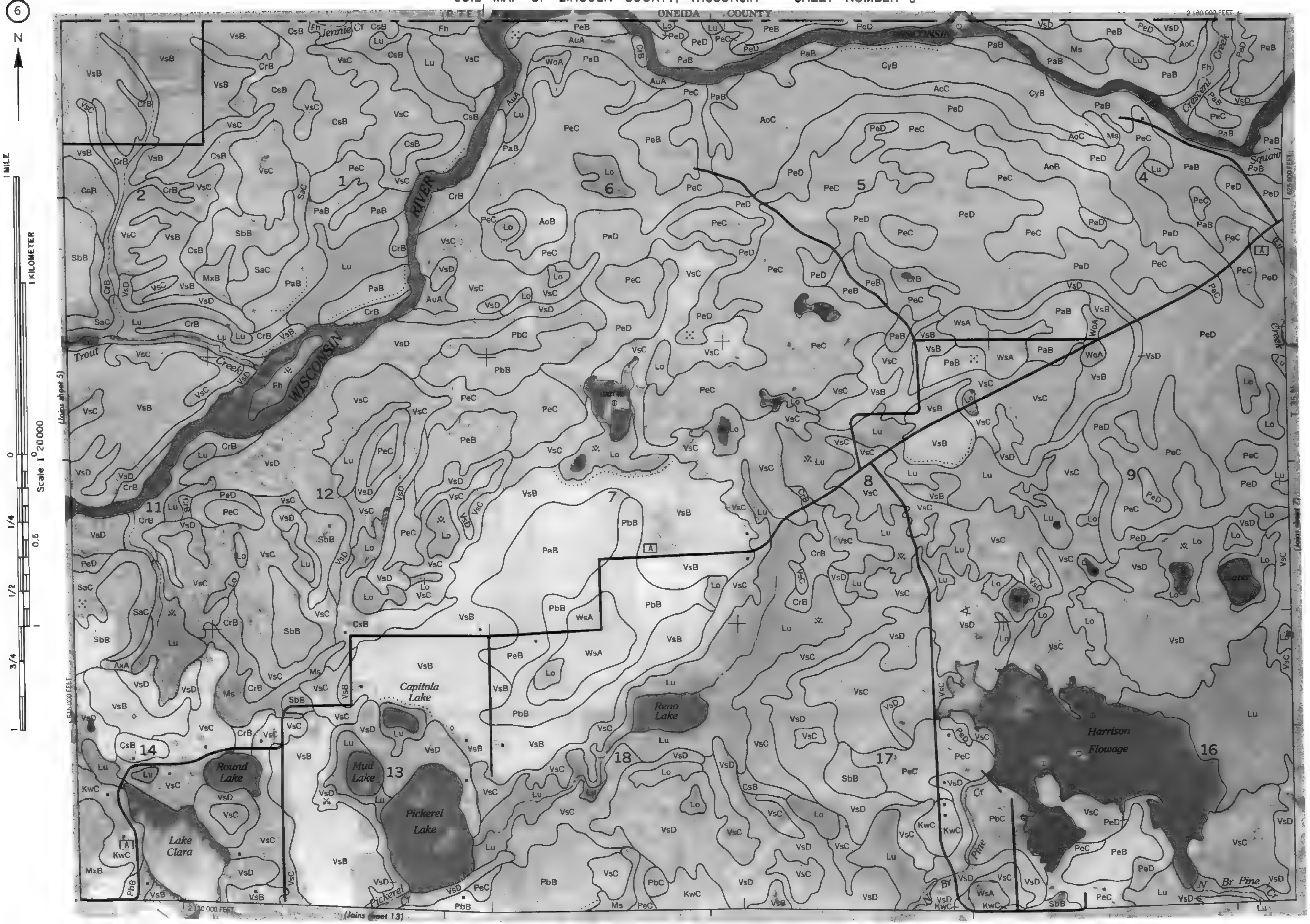
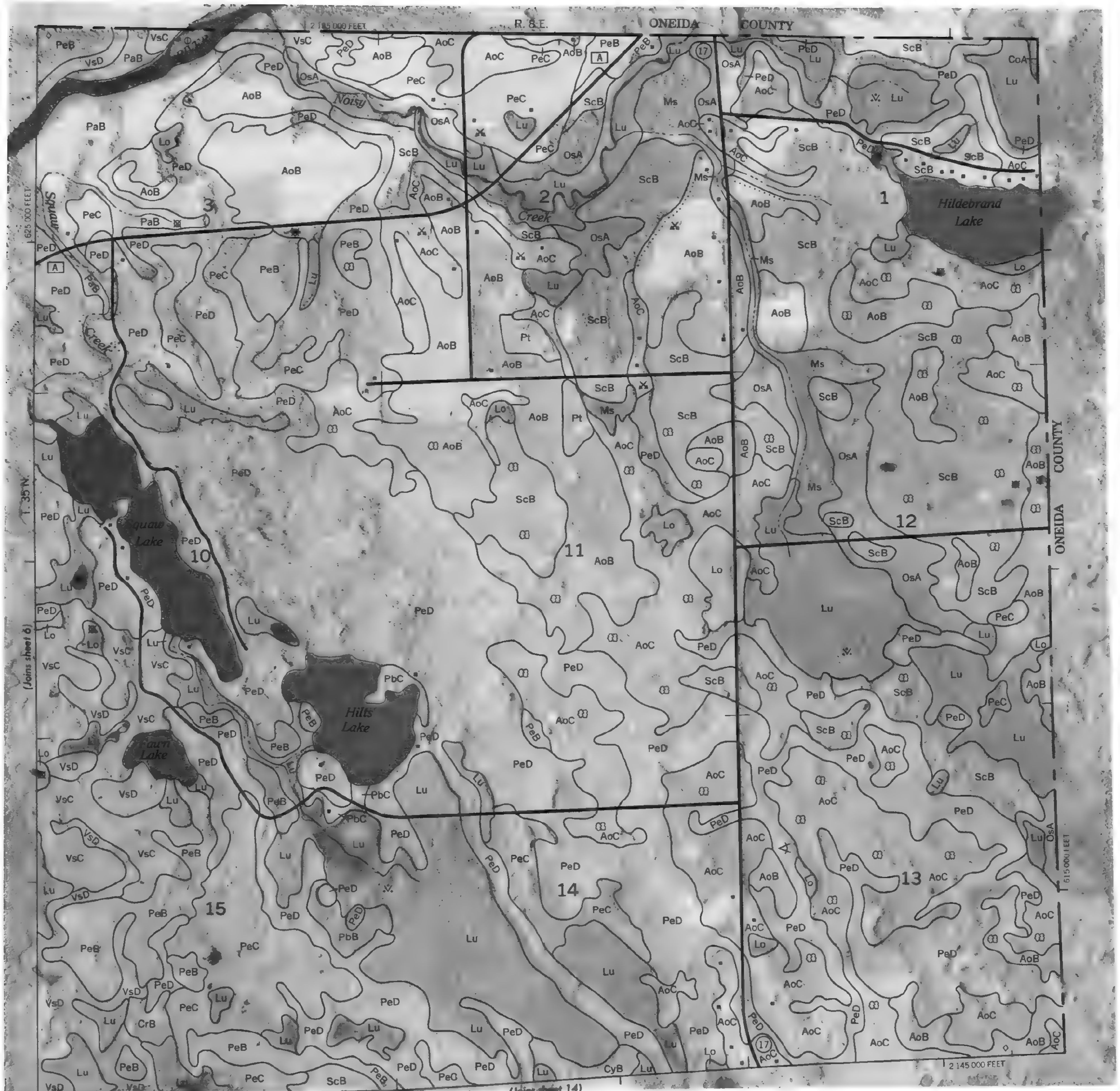
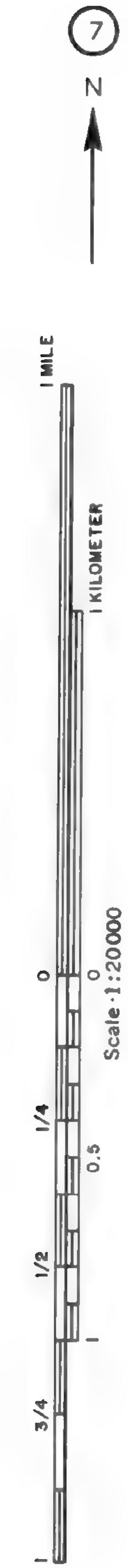
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 6



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





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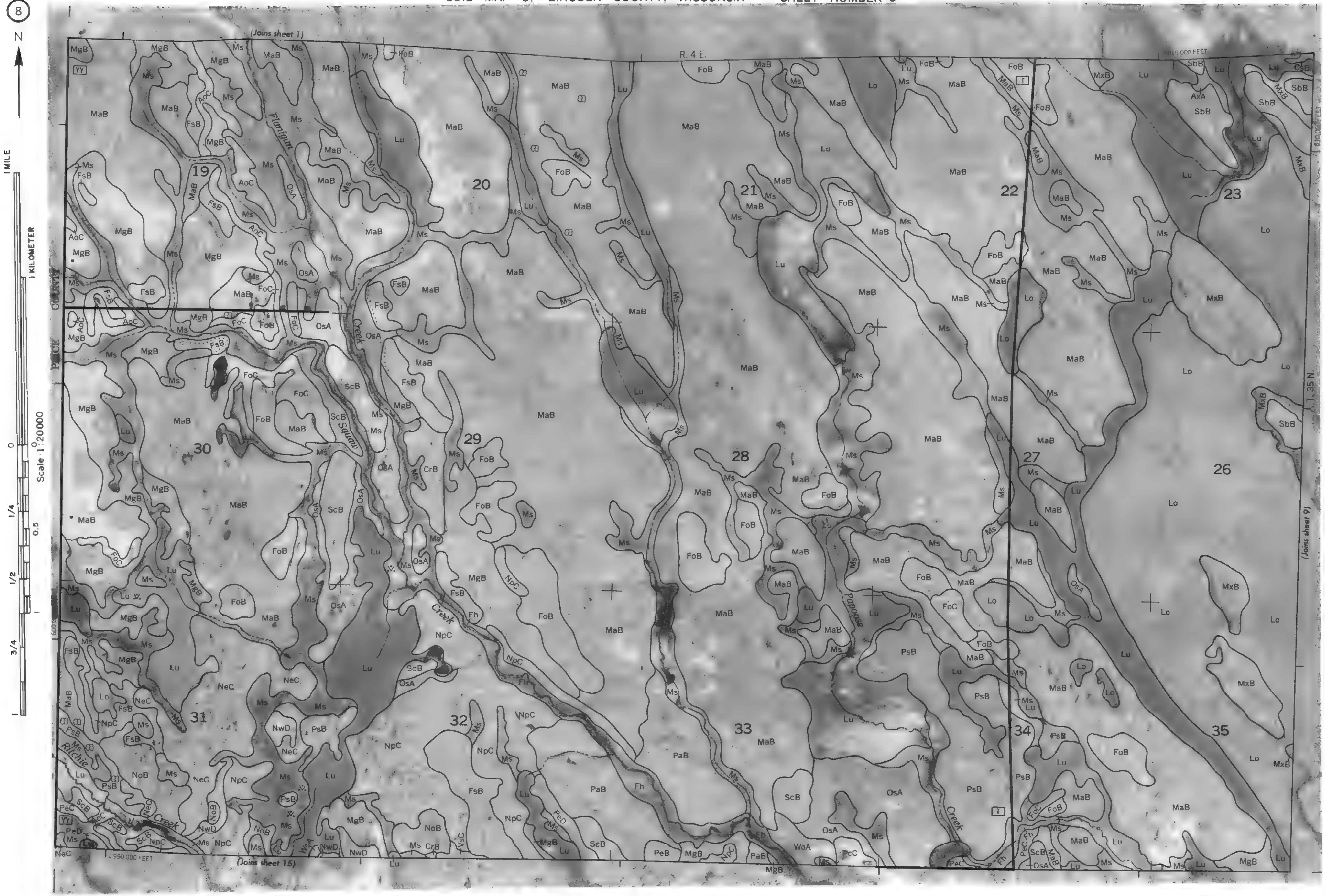
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 8



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SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 9

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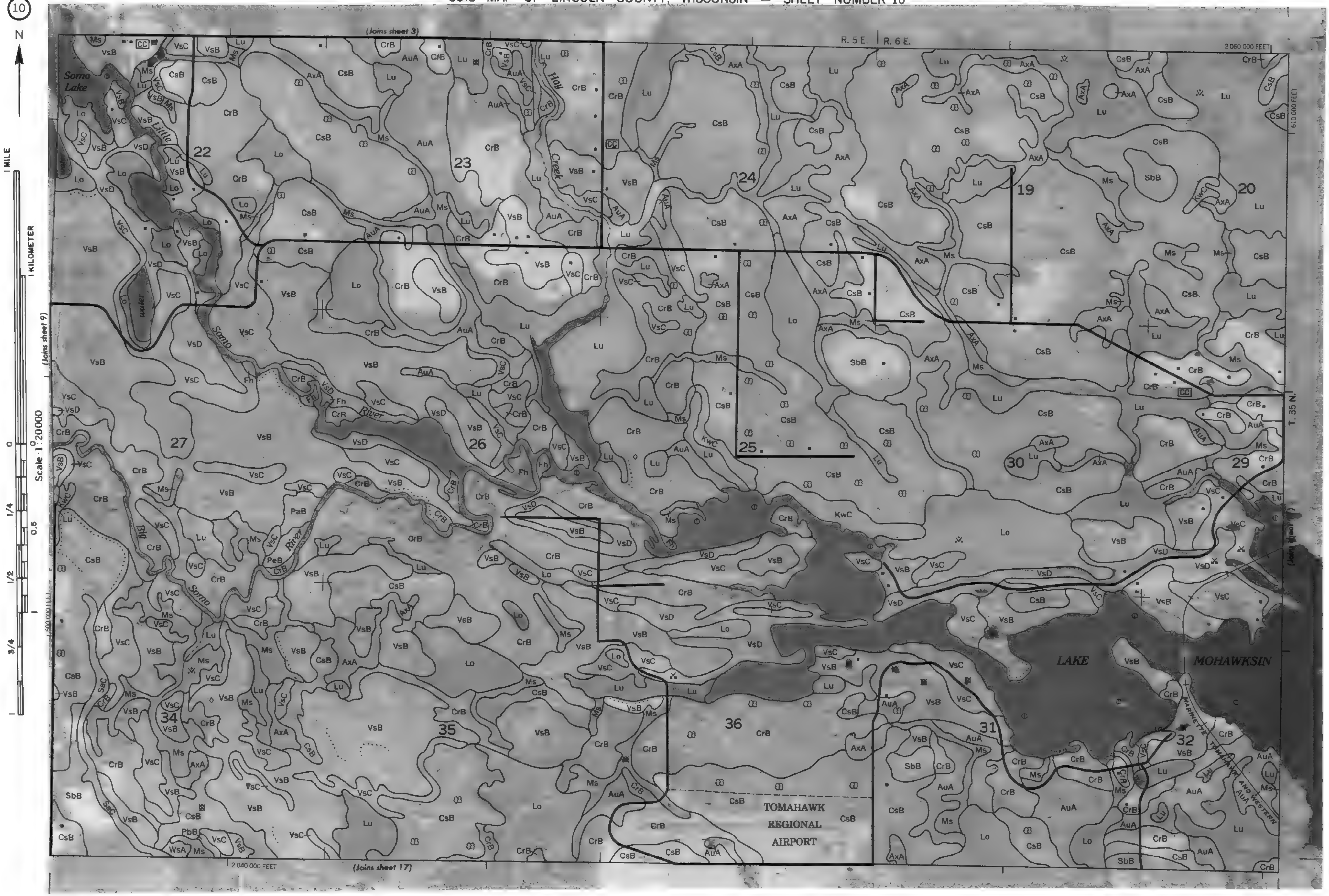
10

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 10



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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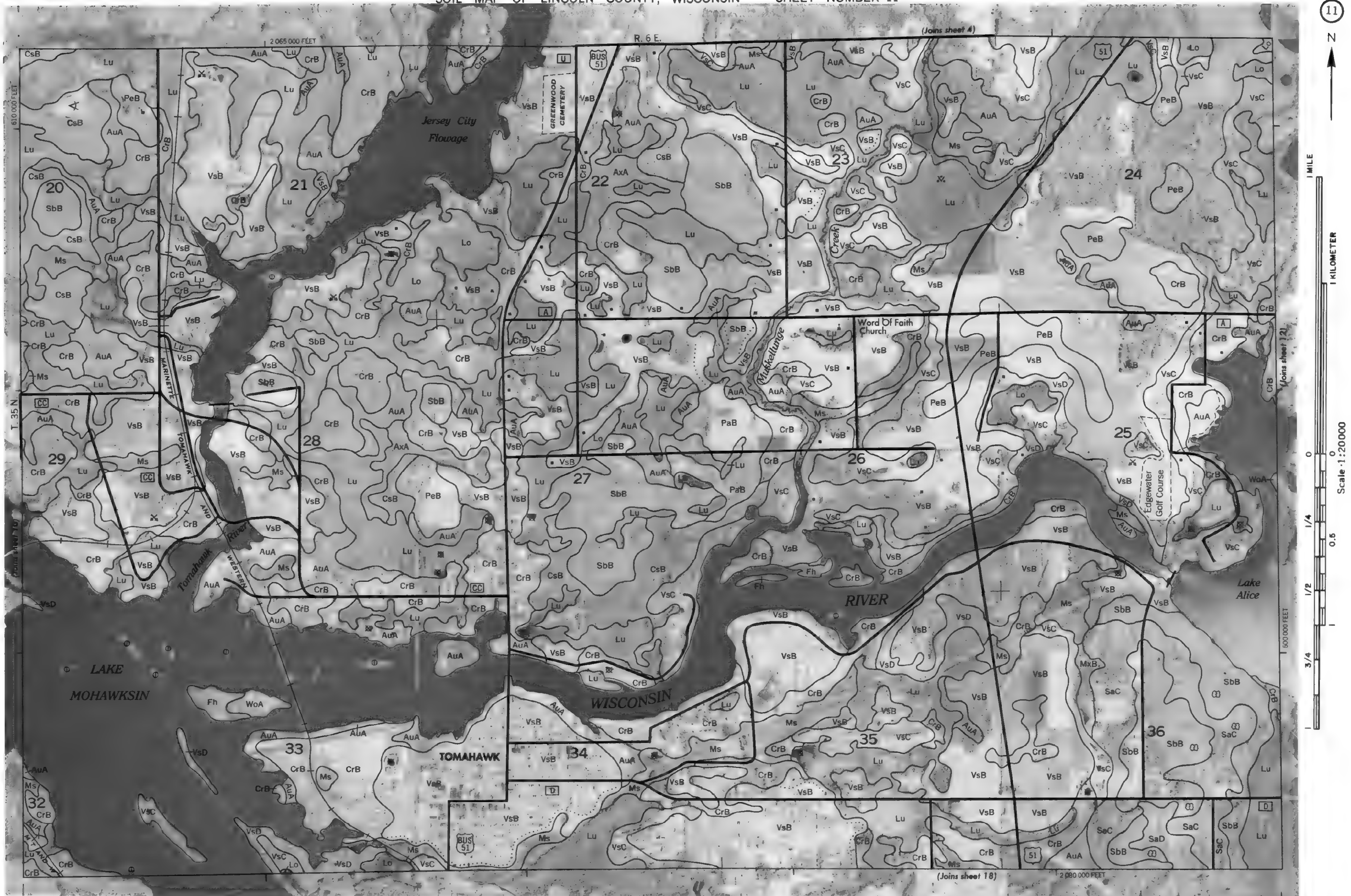
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 11



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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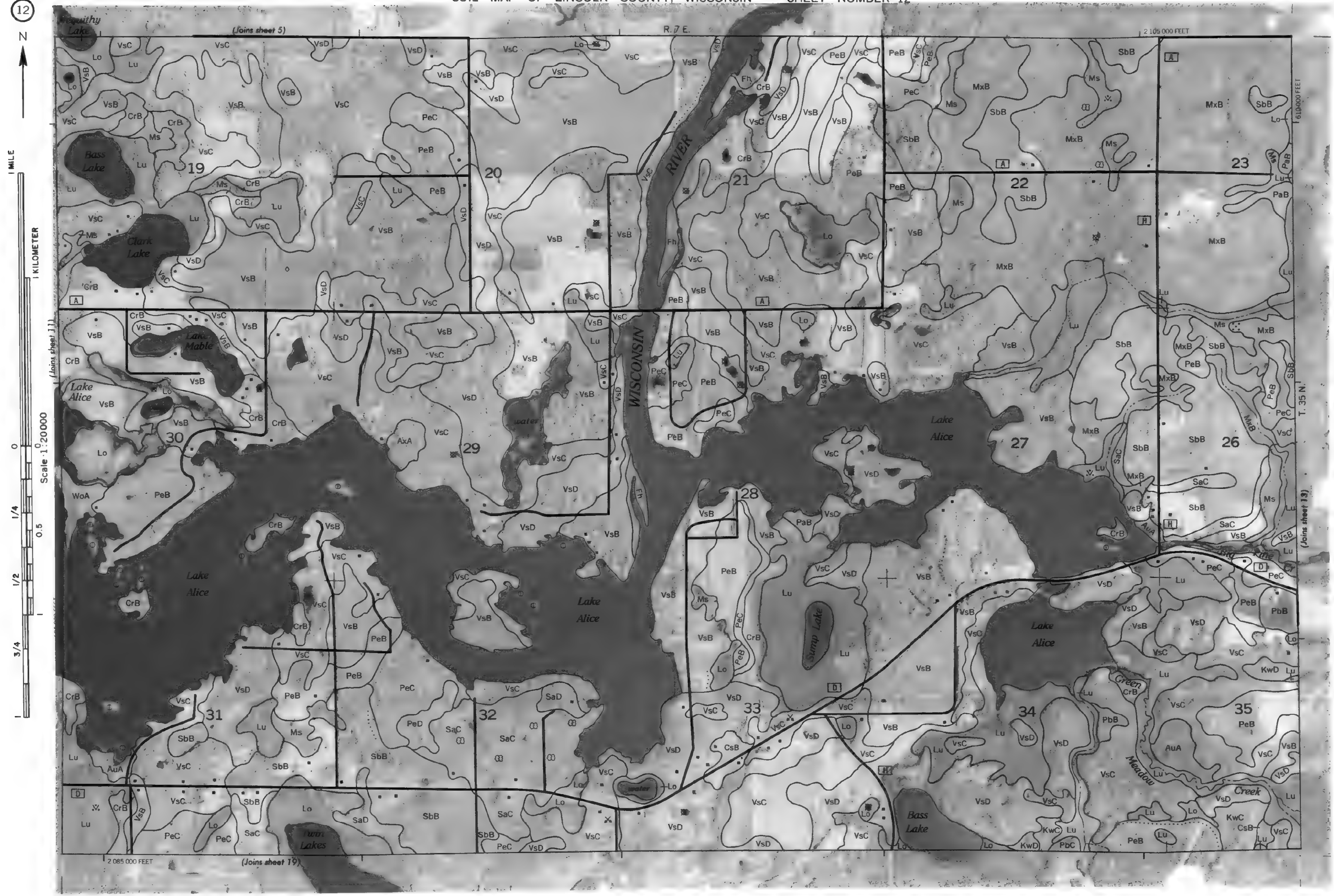
(12)

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 12



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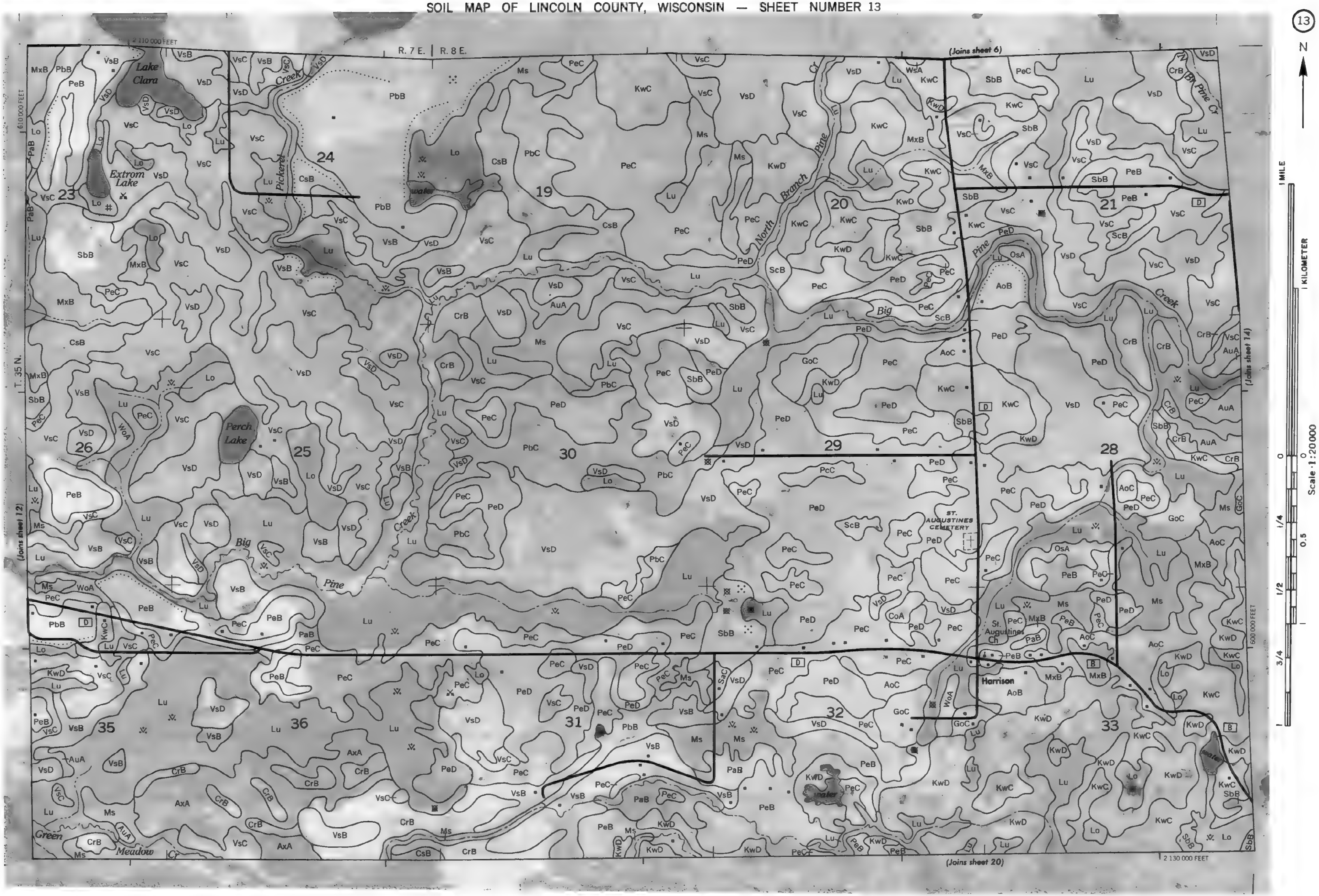
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 13



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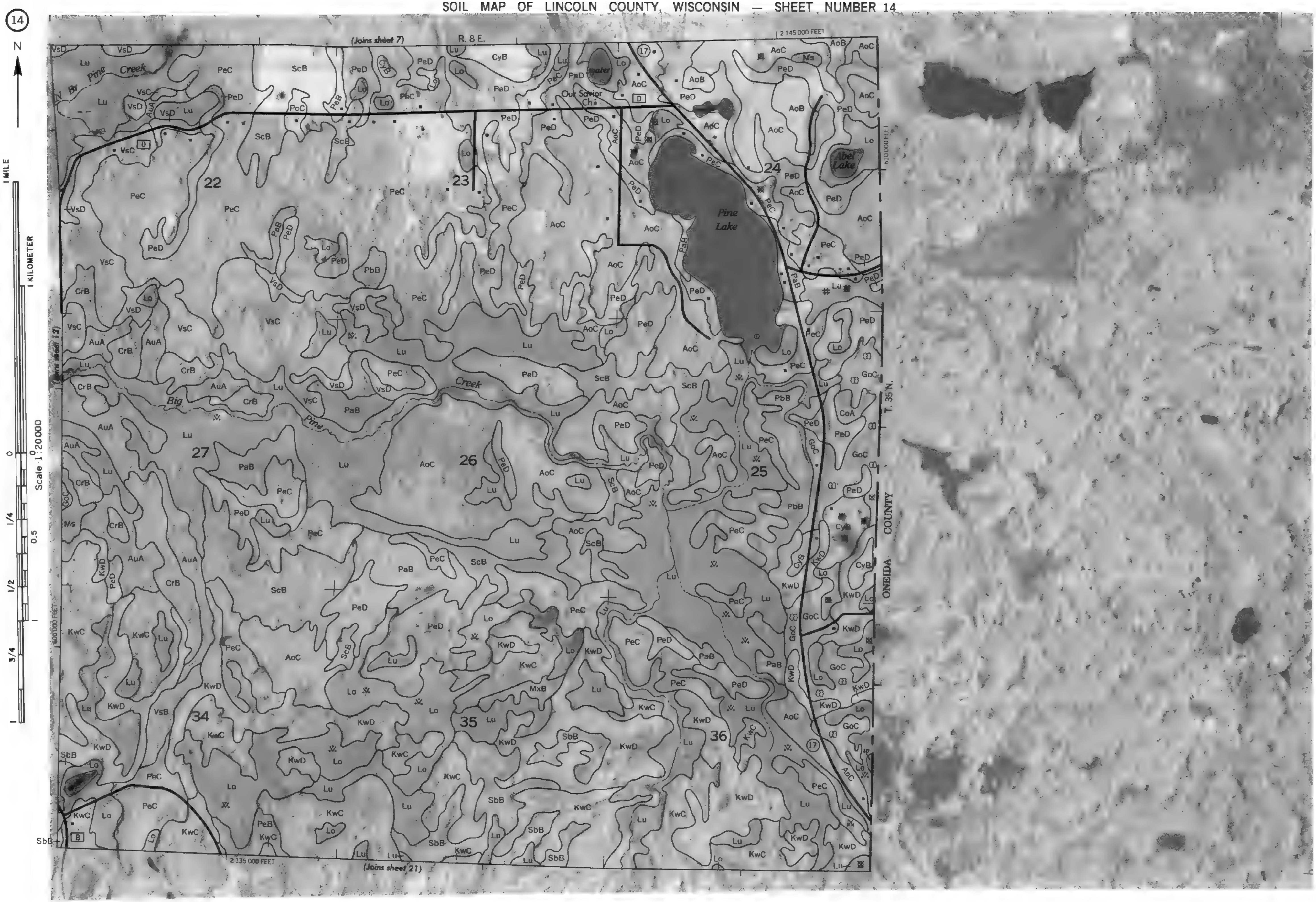
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 14



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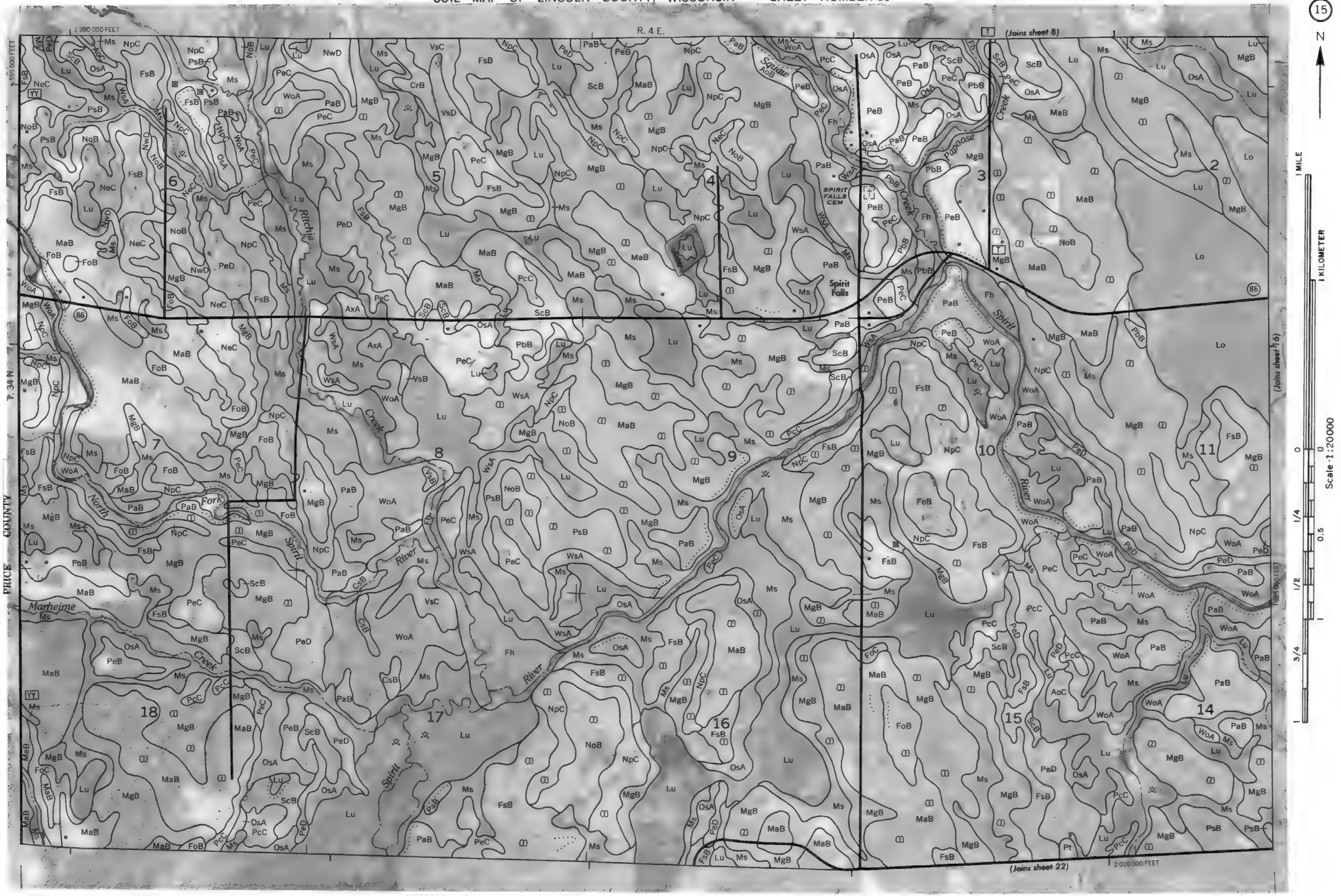
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 15



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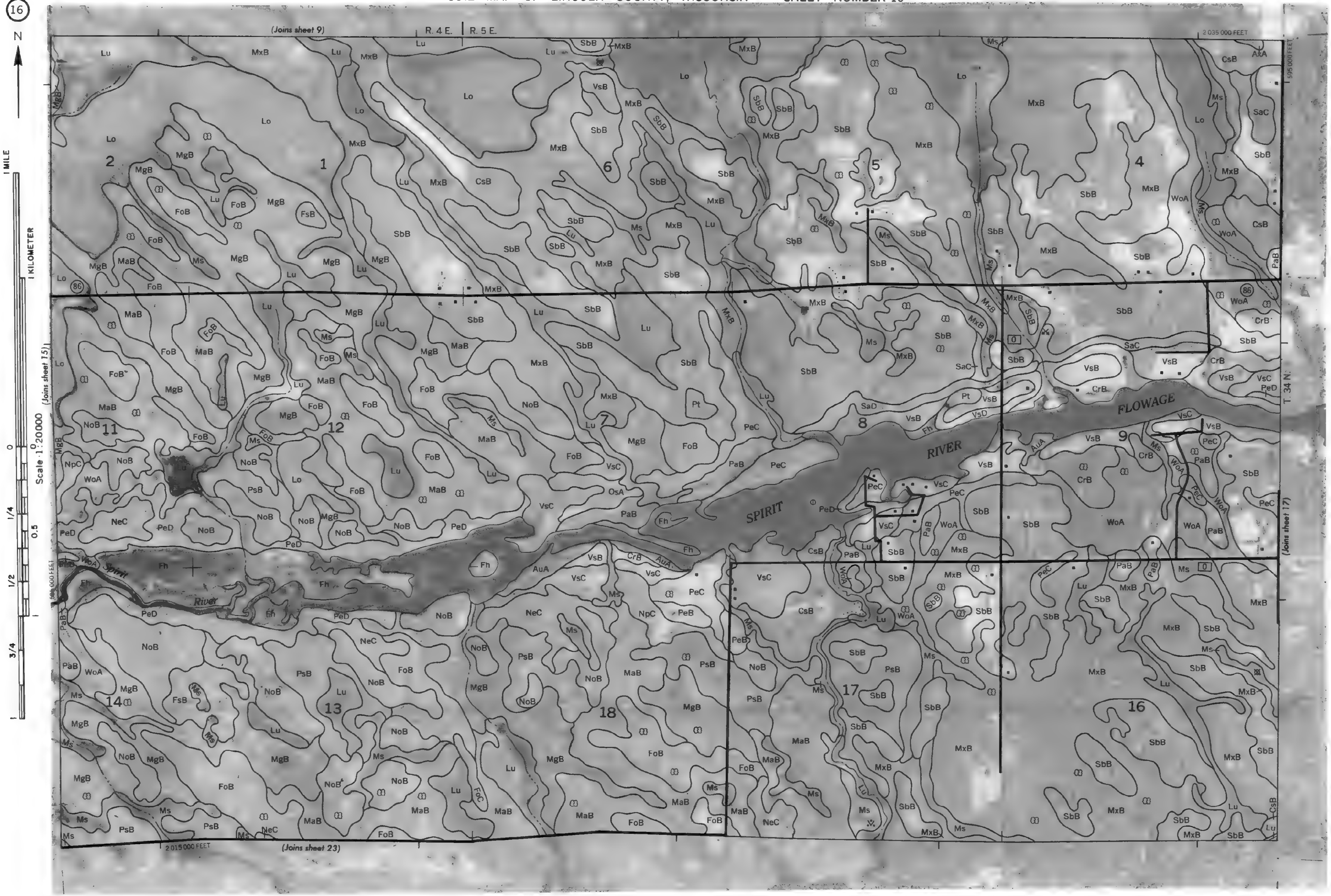
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 16



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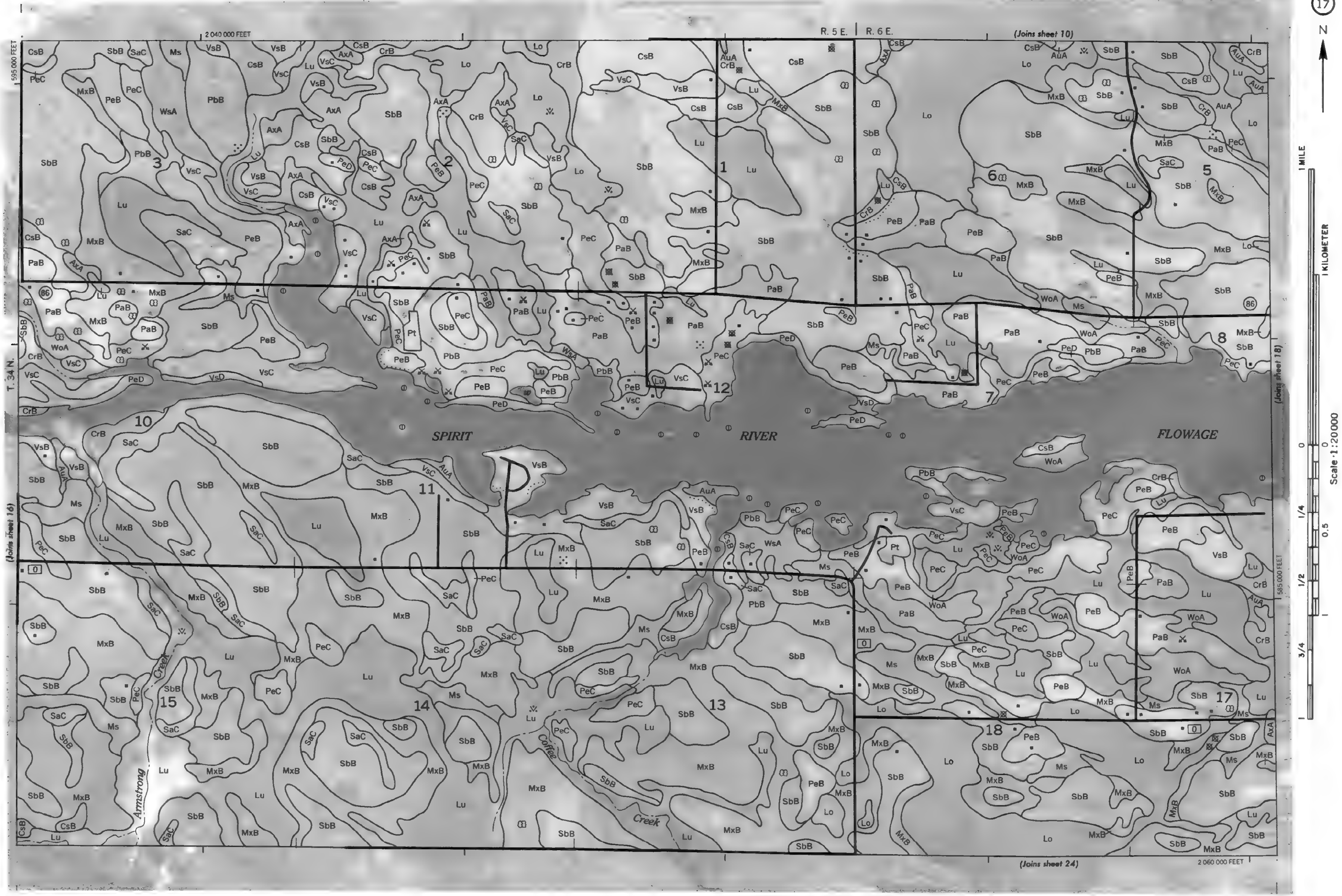
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 17



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SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 18

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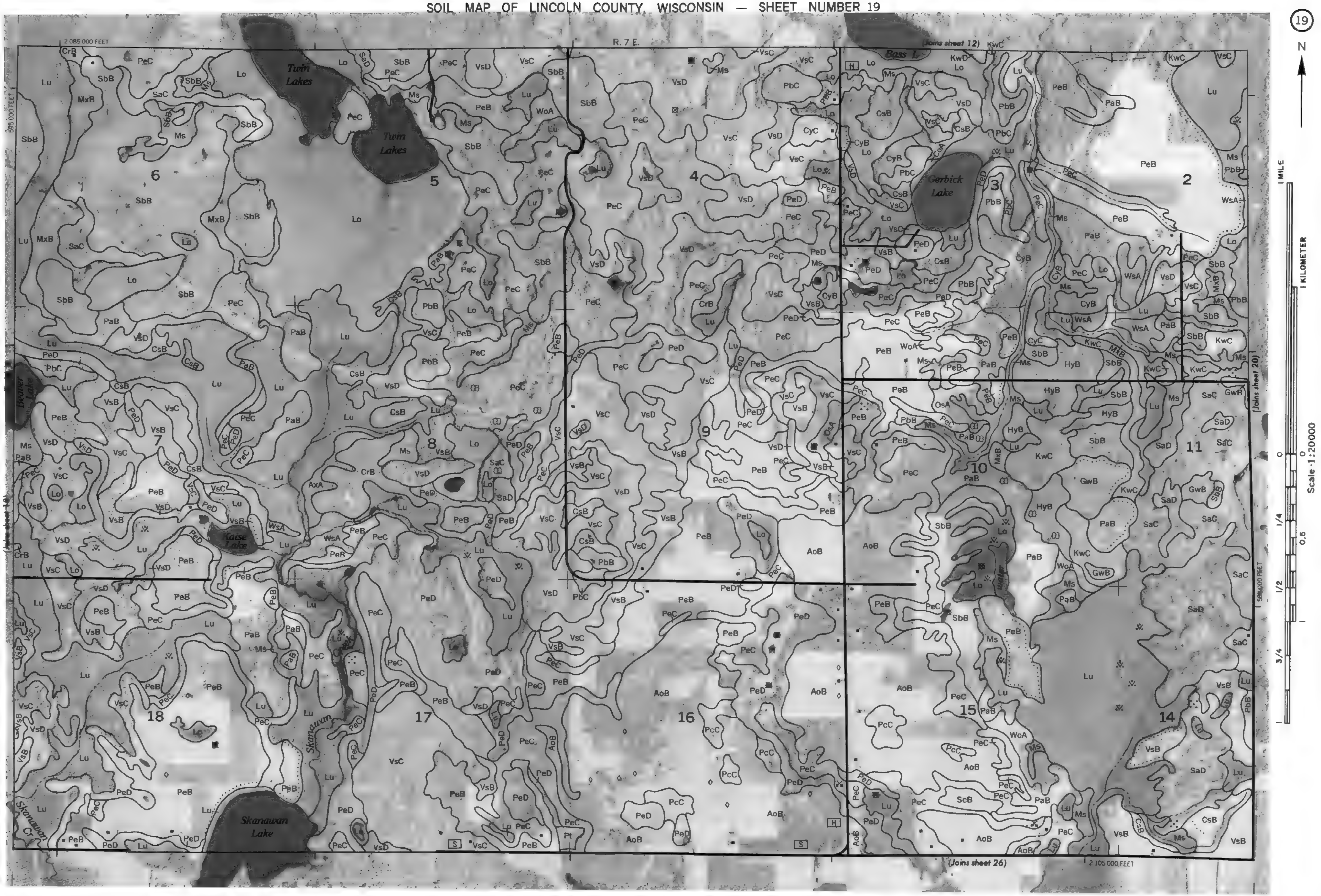

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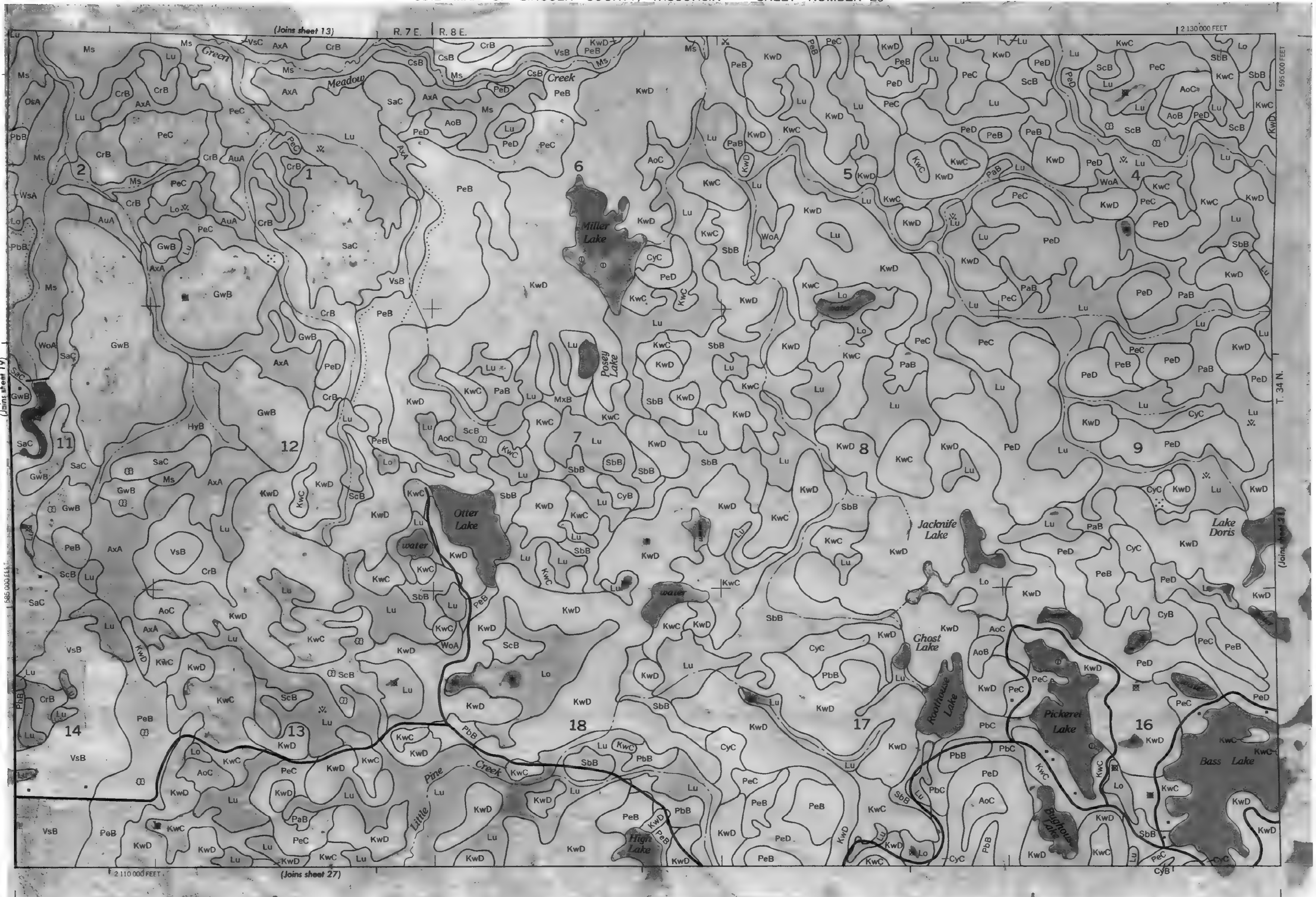
20

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 20



This soil survey map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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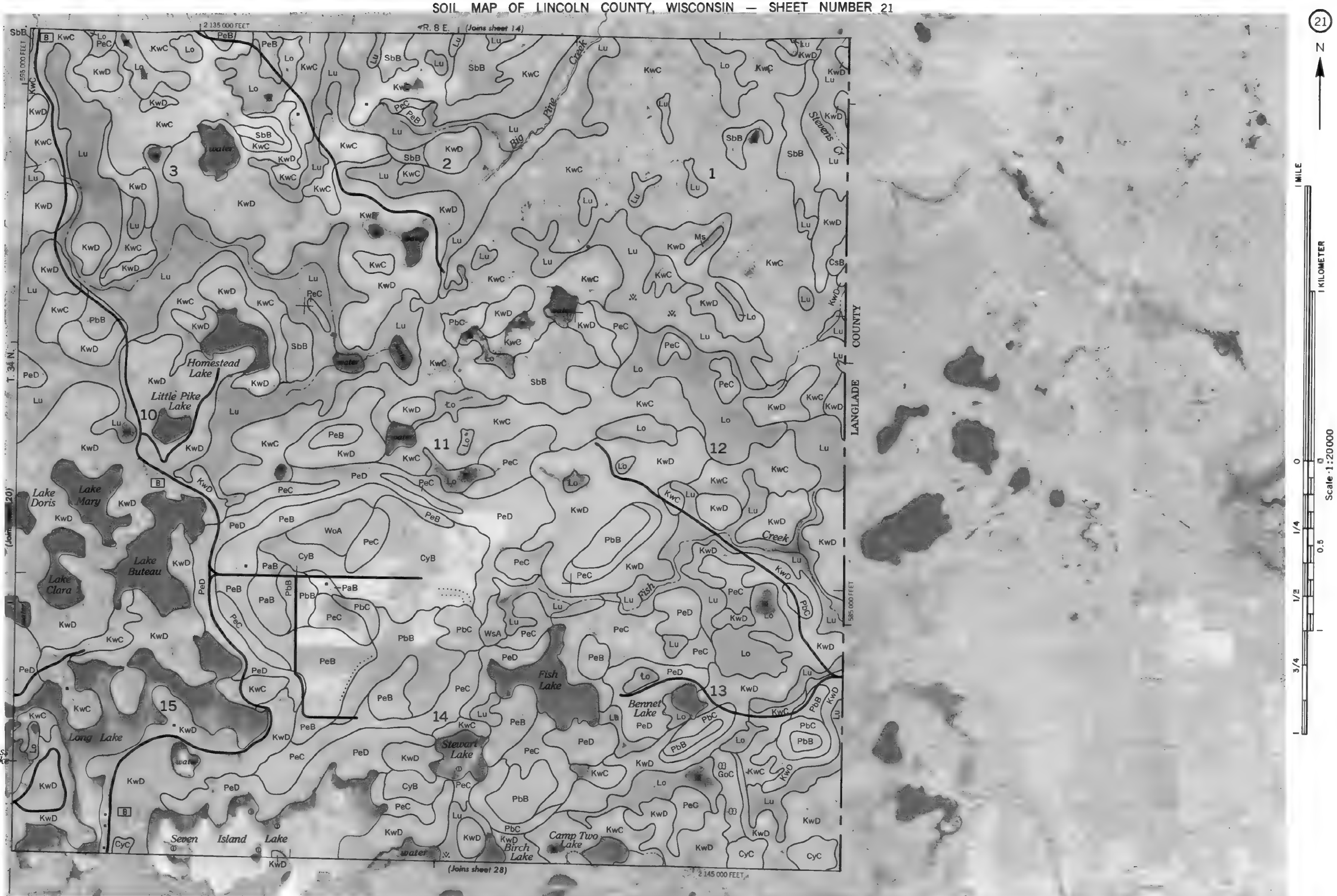

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SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 22

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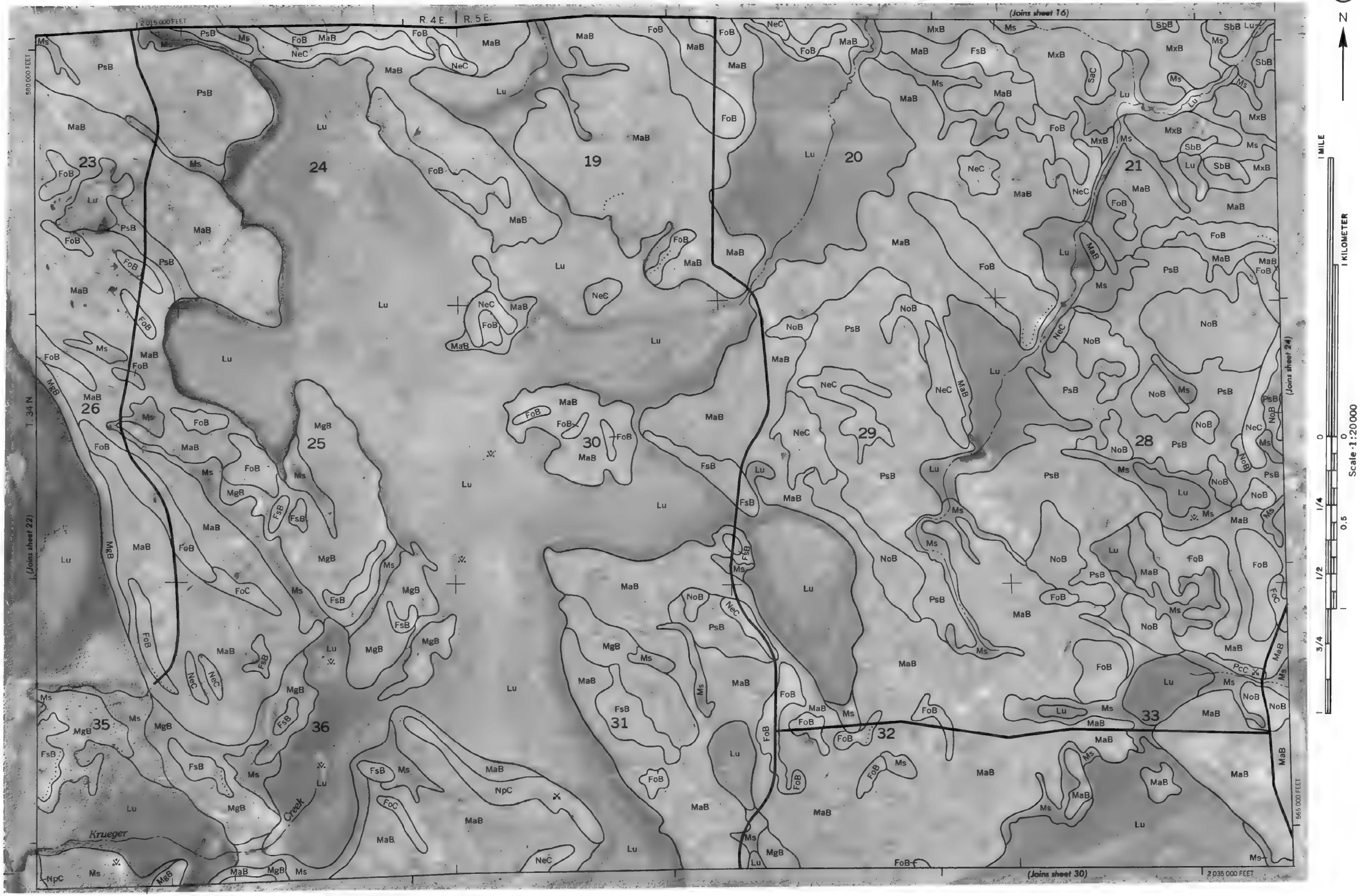

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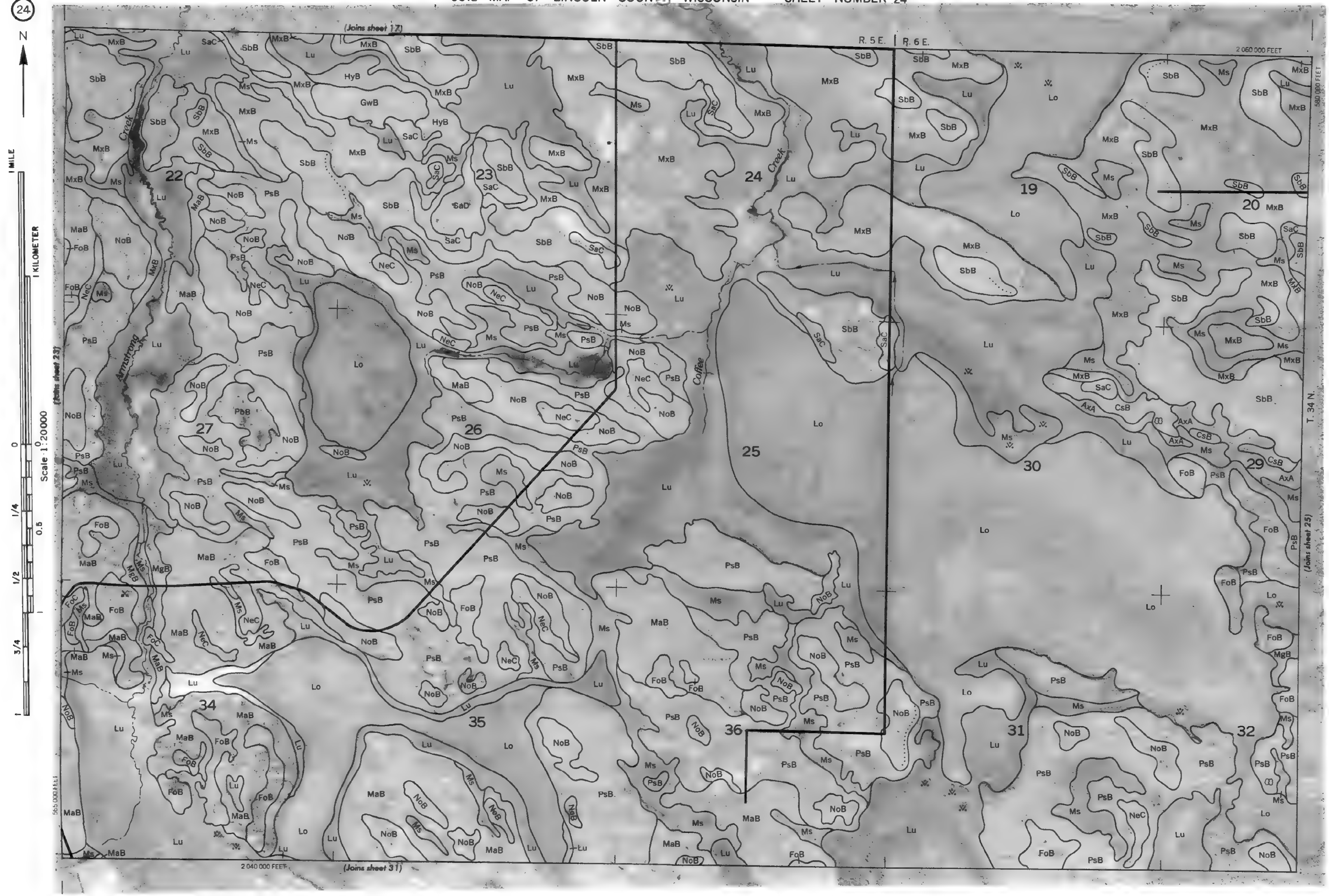
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 24



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SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 25

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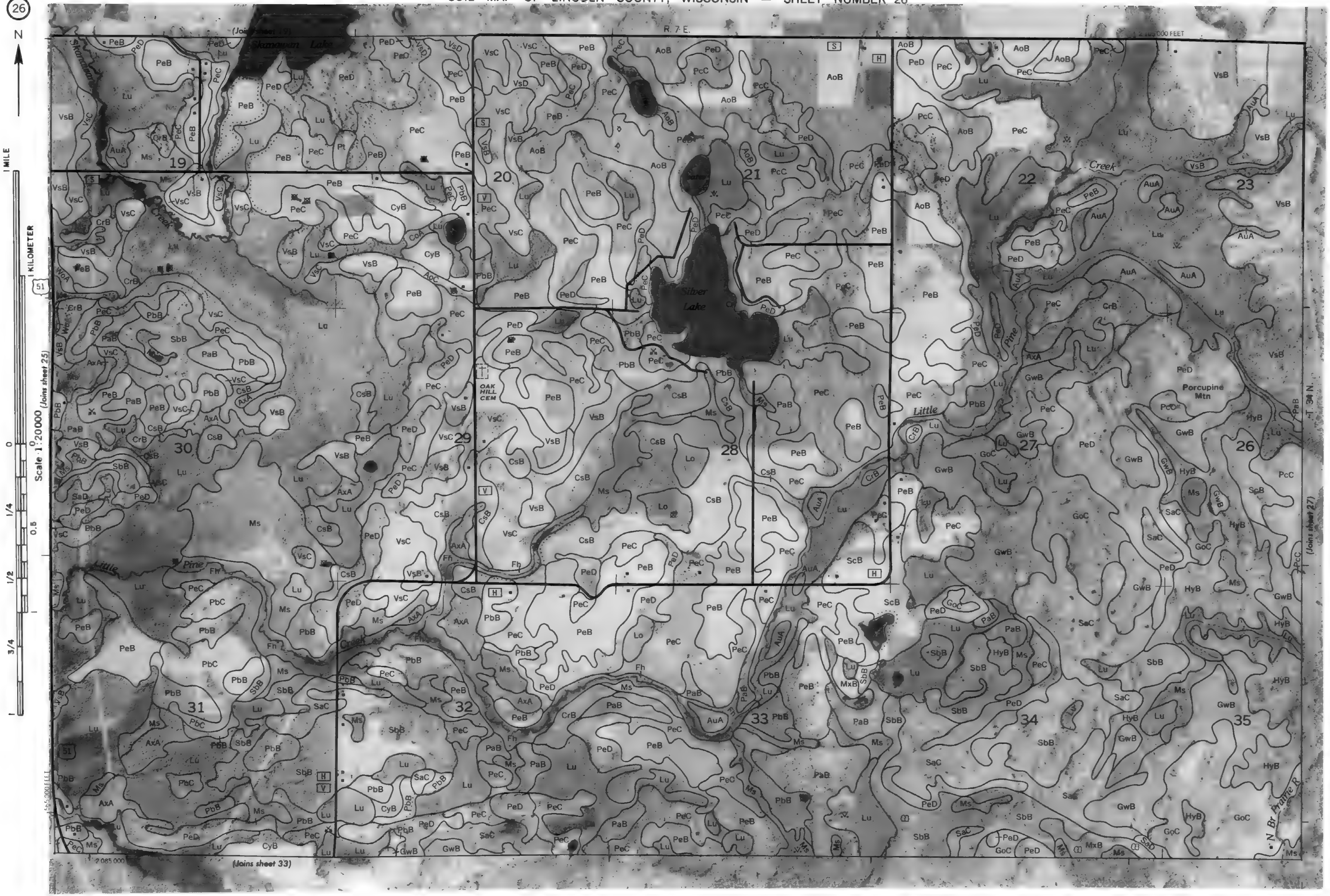
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 26



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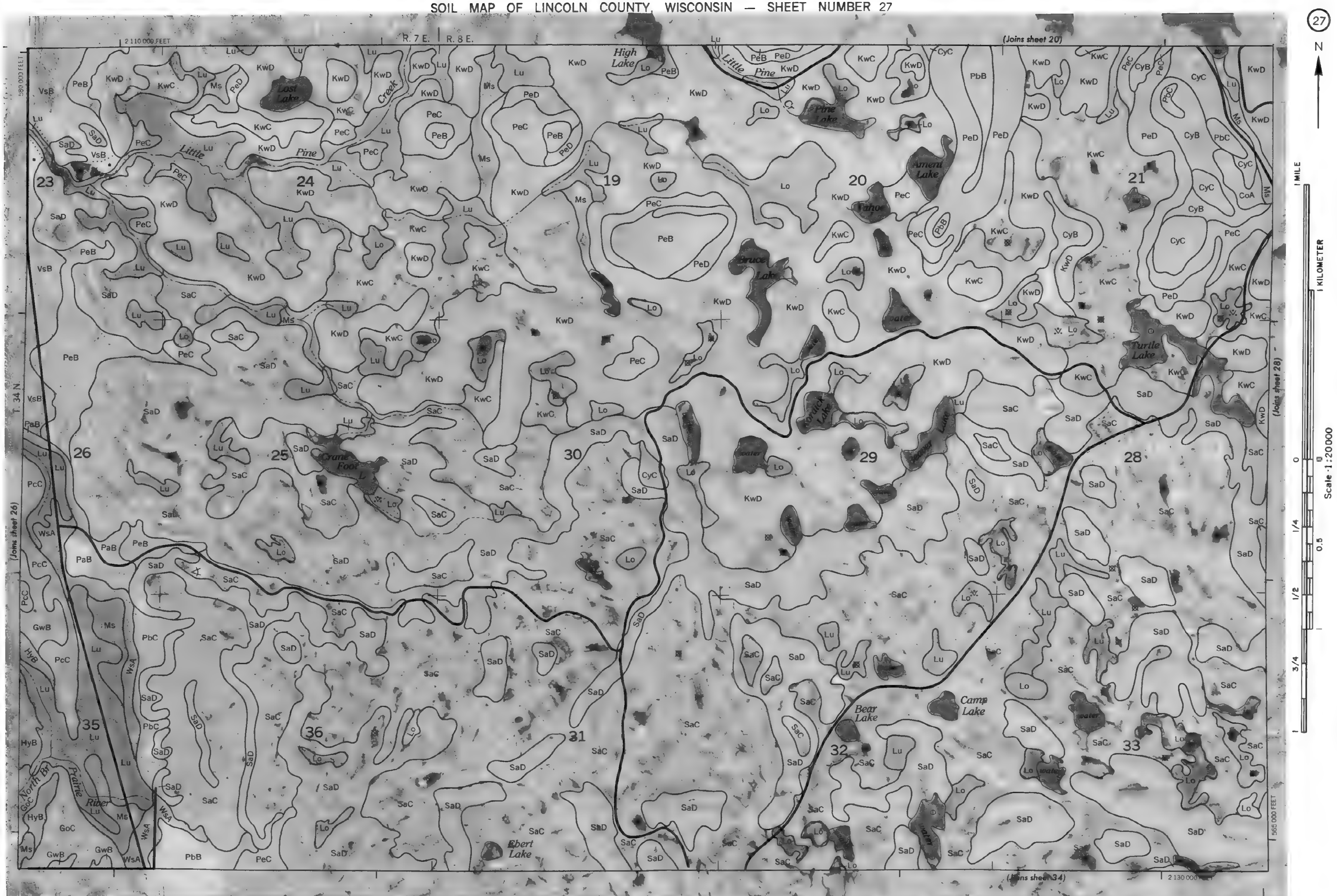
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 27



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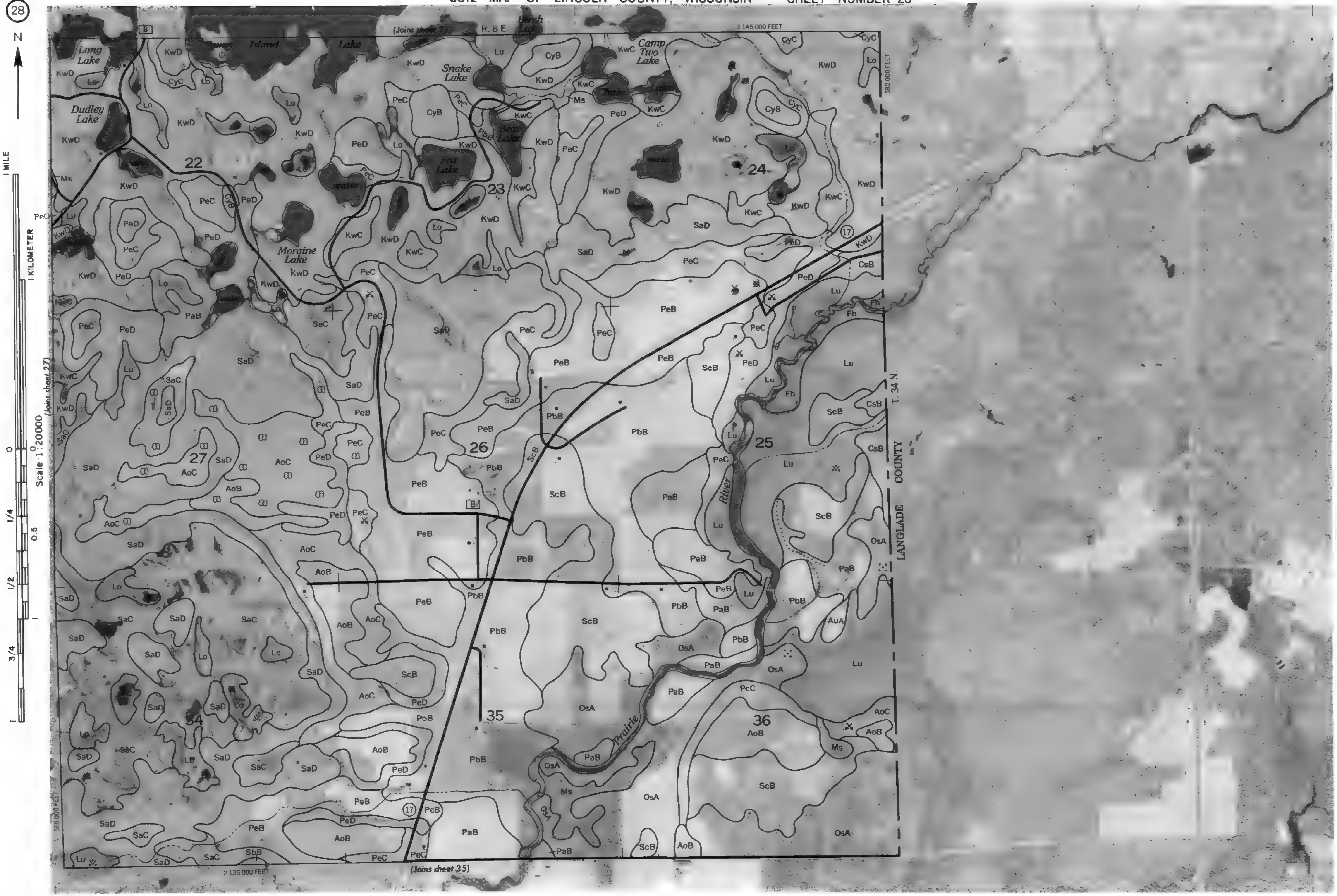
28

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 28



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SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 29

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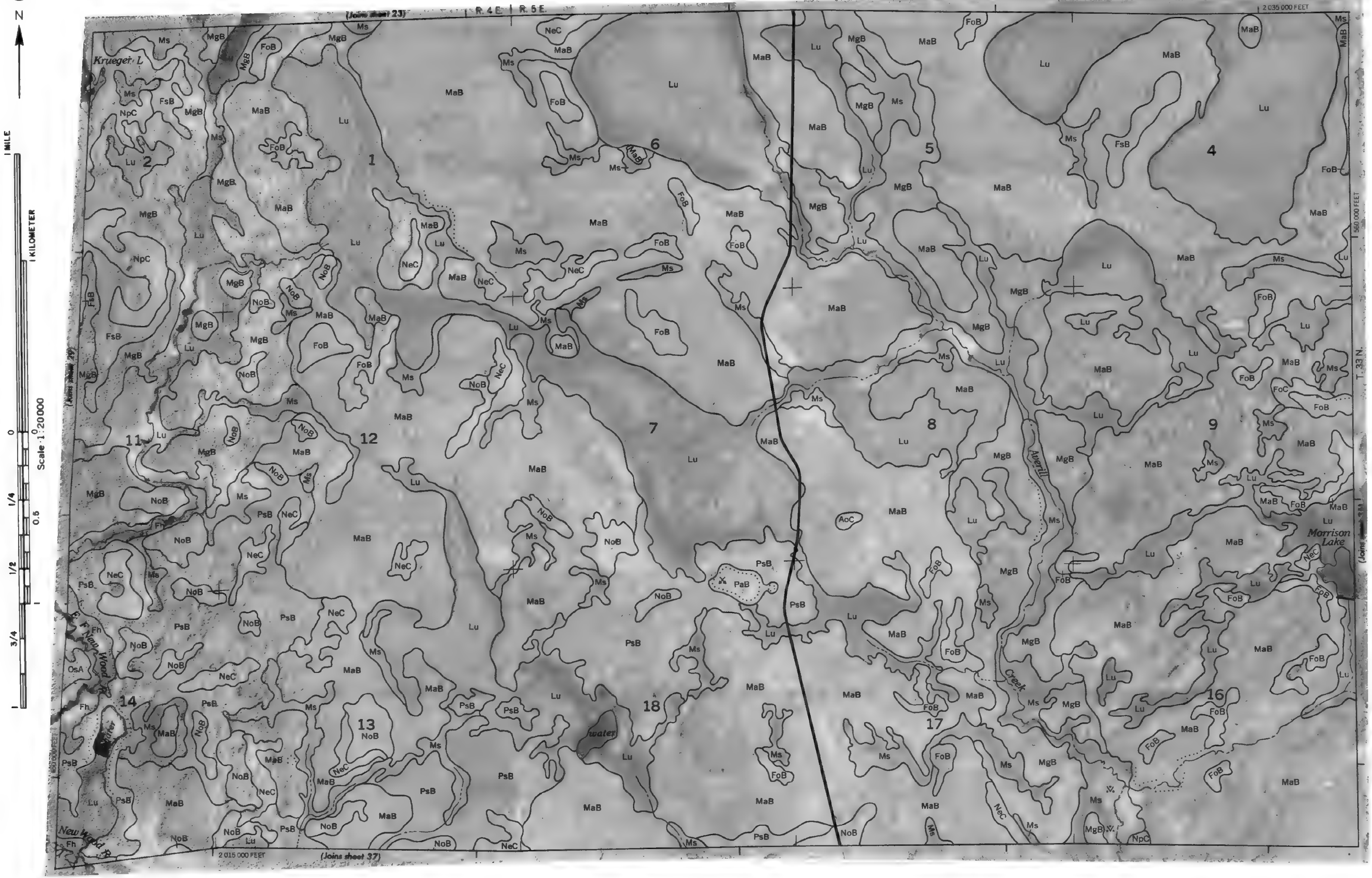
30

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 30



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SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 31

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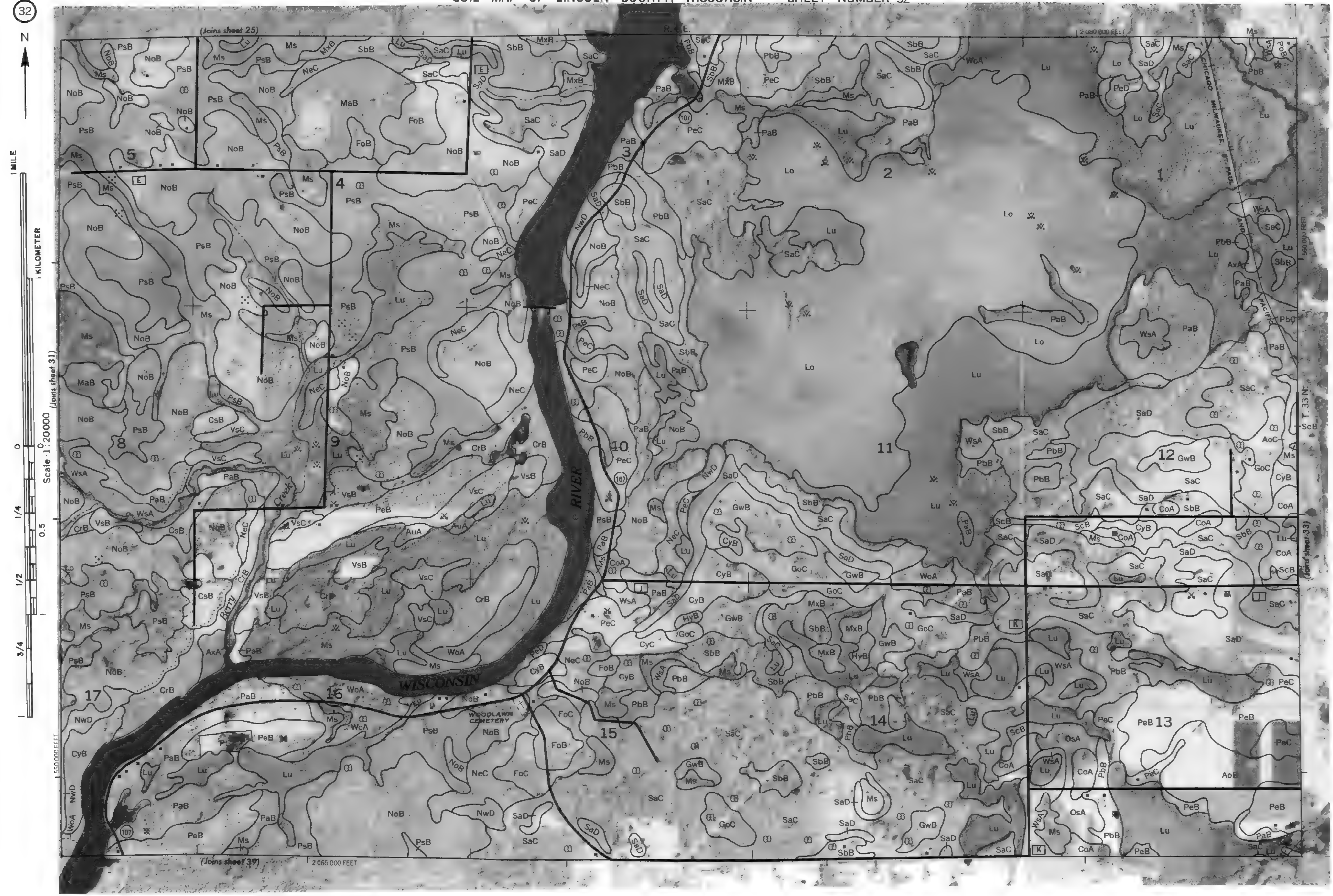
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 32



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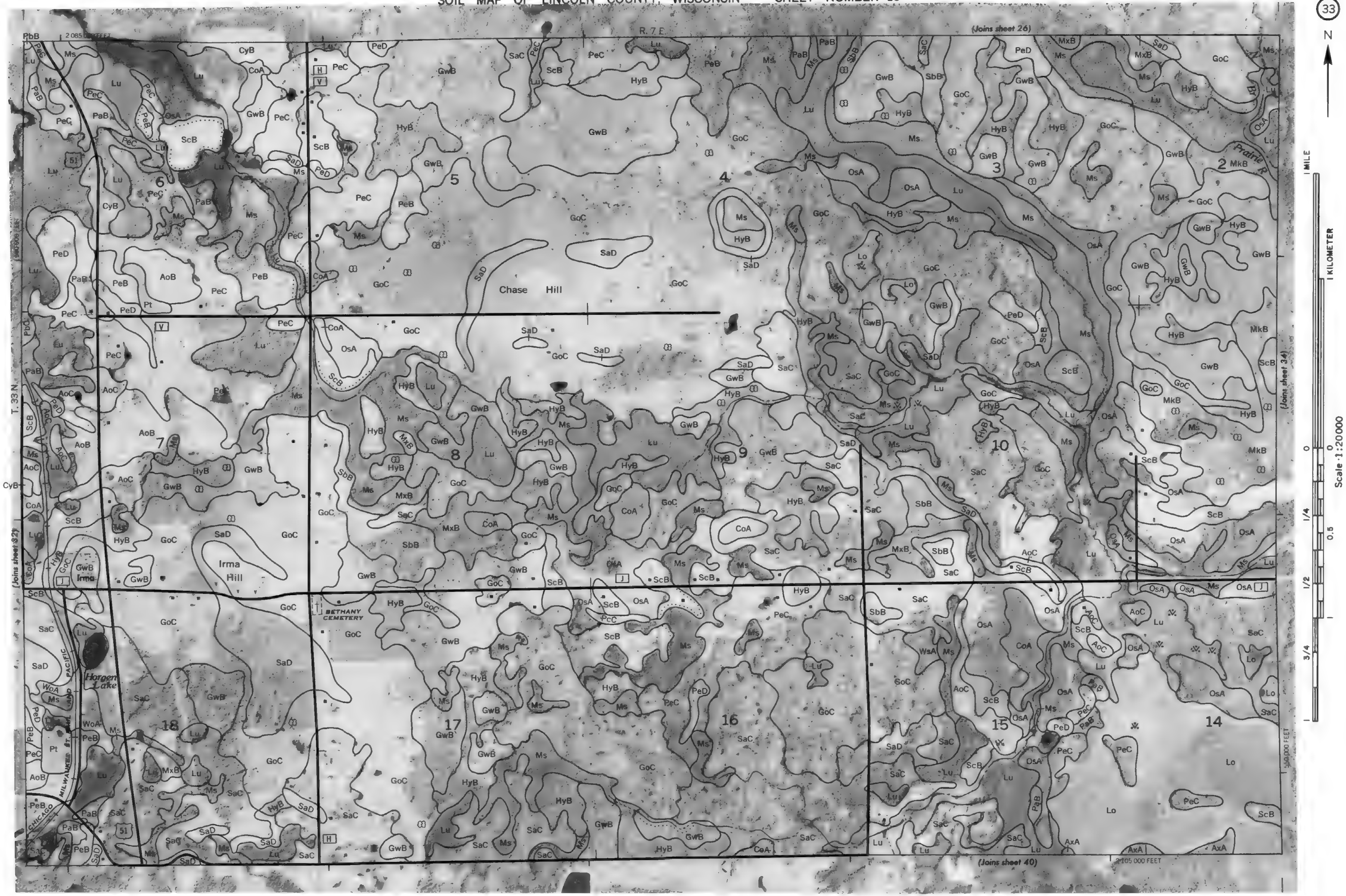
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 33



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SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 34

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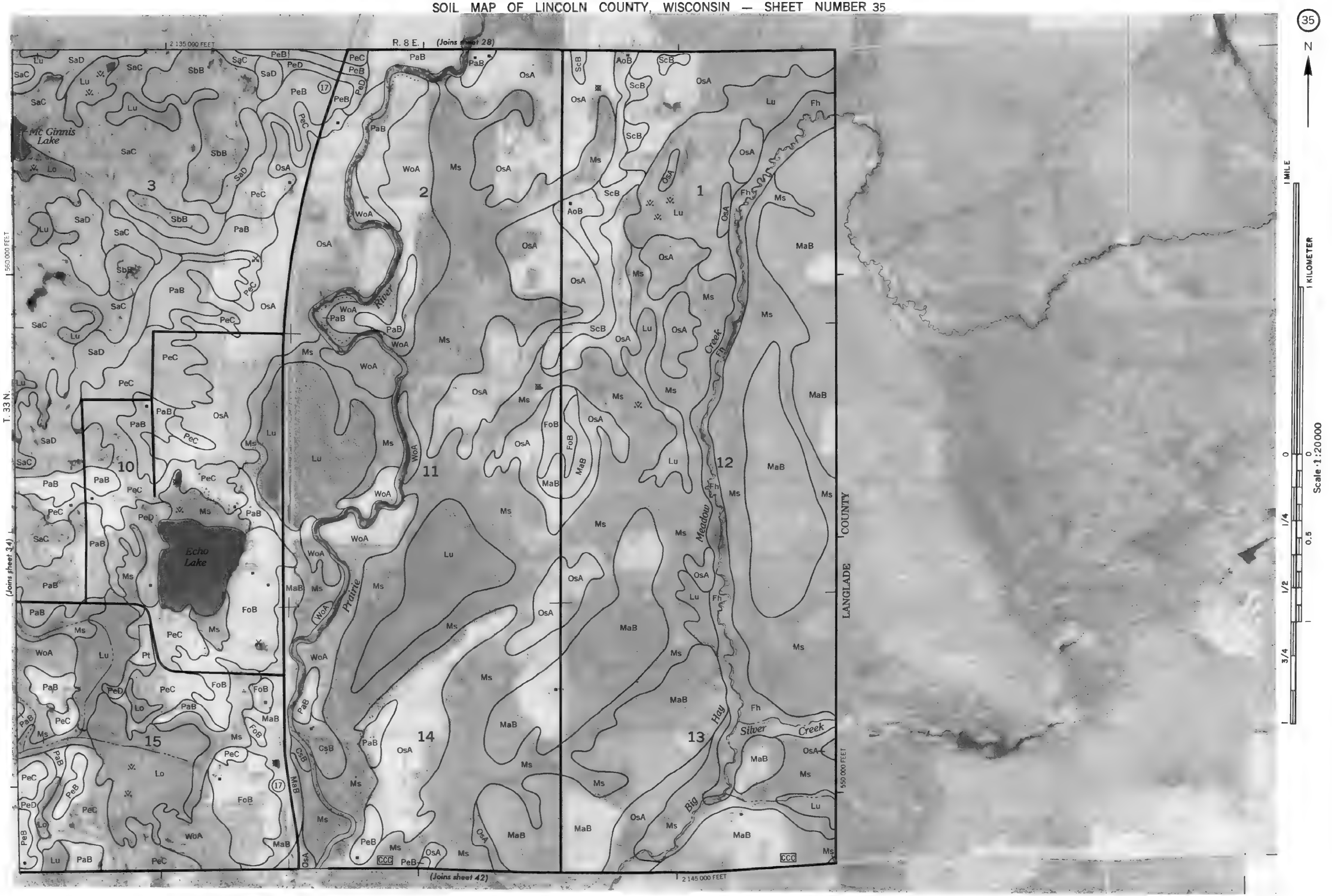

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SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 36

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SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 37

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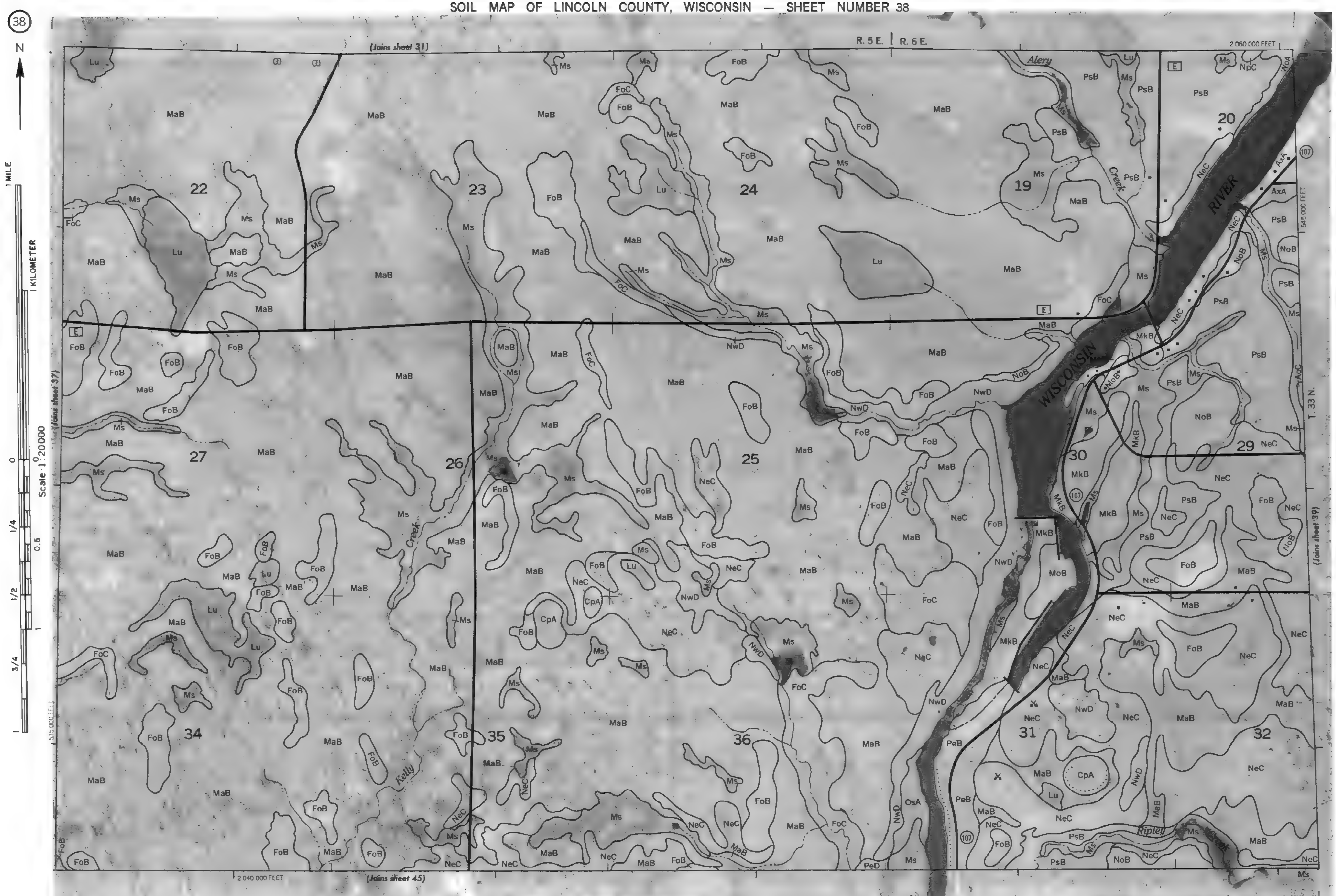
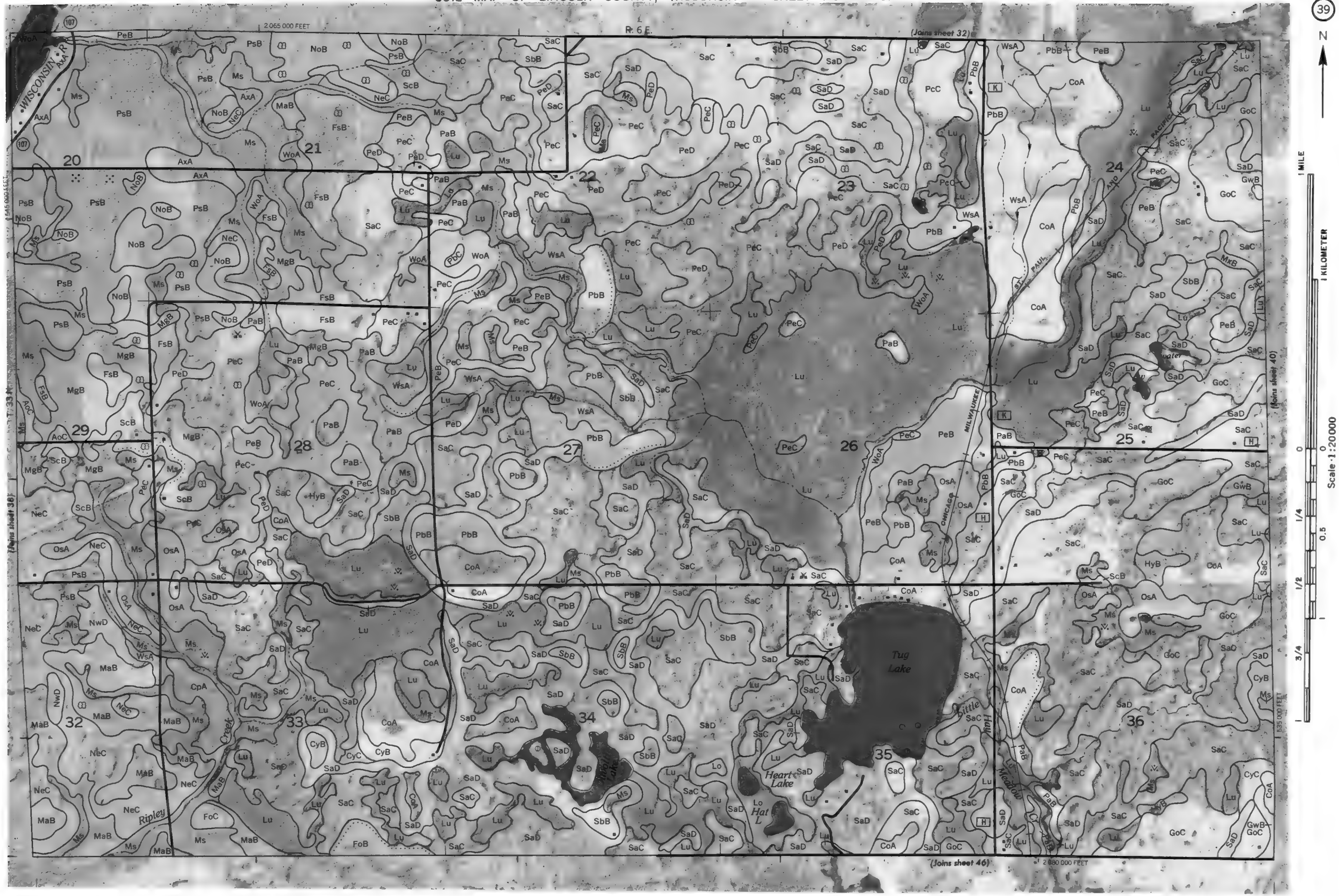
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 38



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 39



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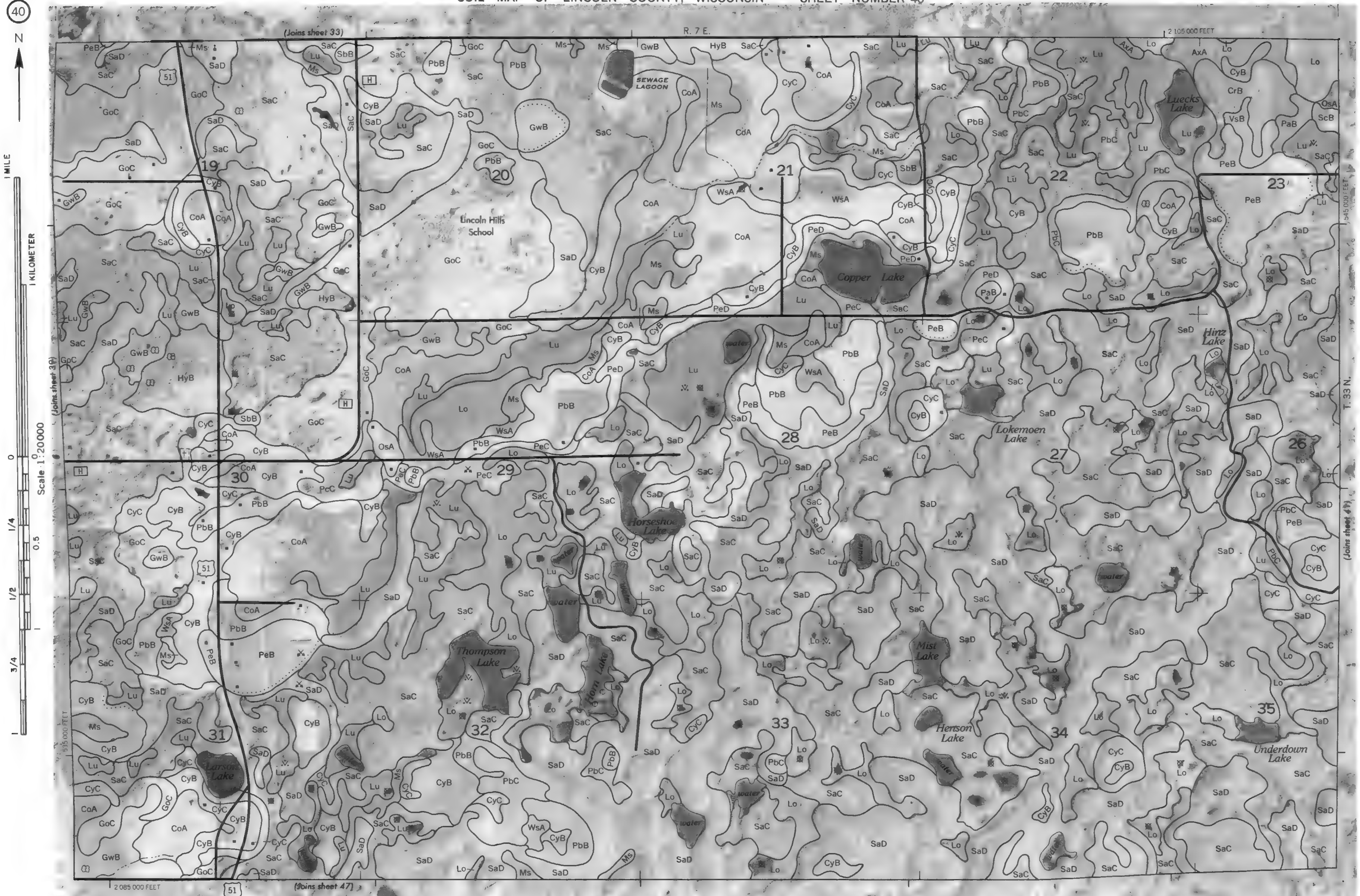
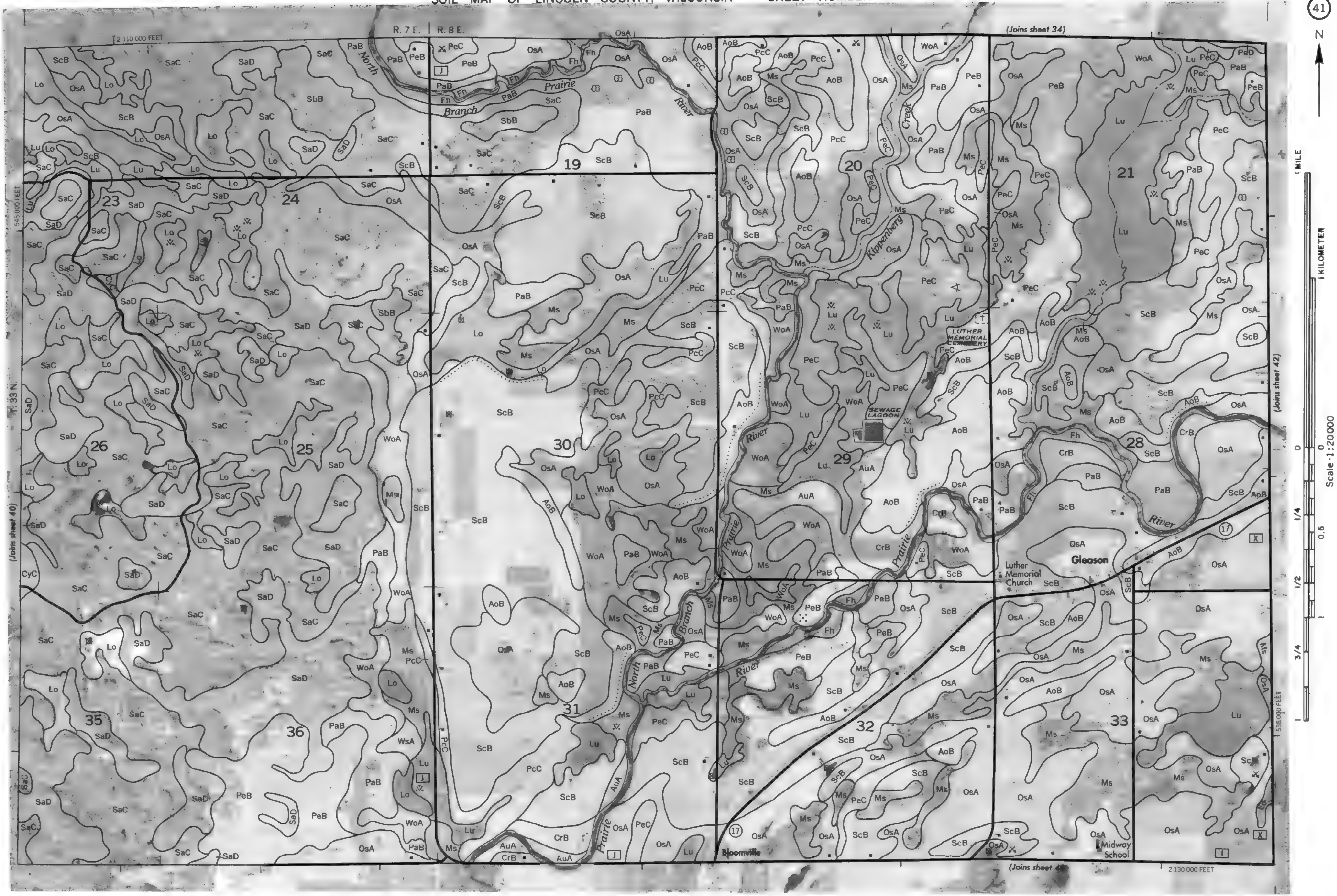
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 40



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 41



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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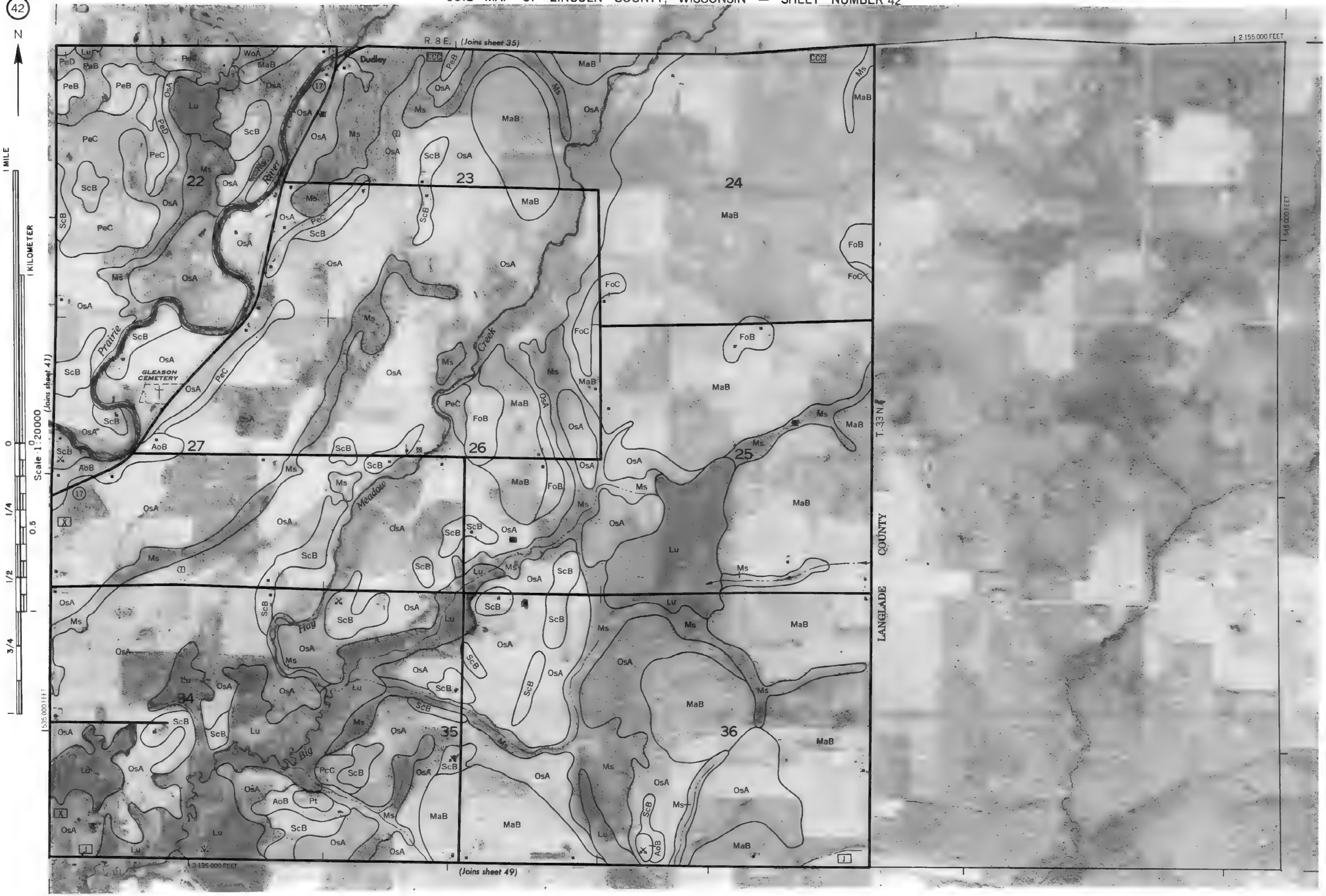
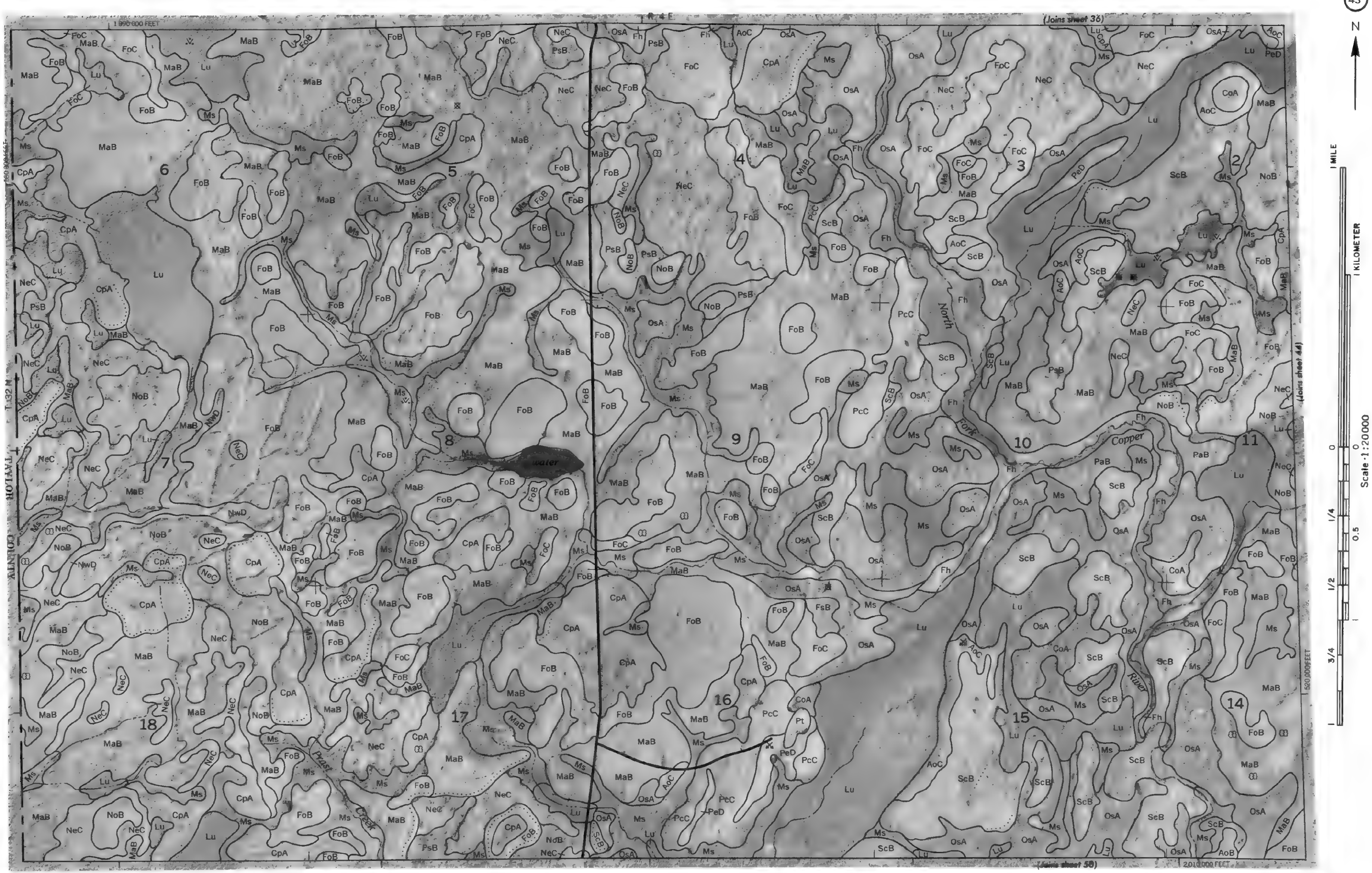
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 42



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 43



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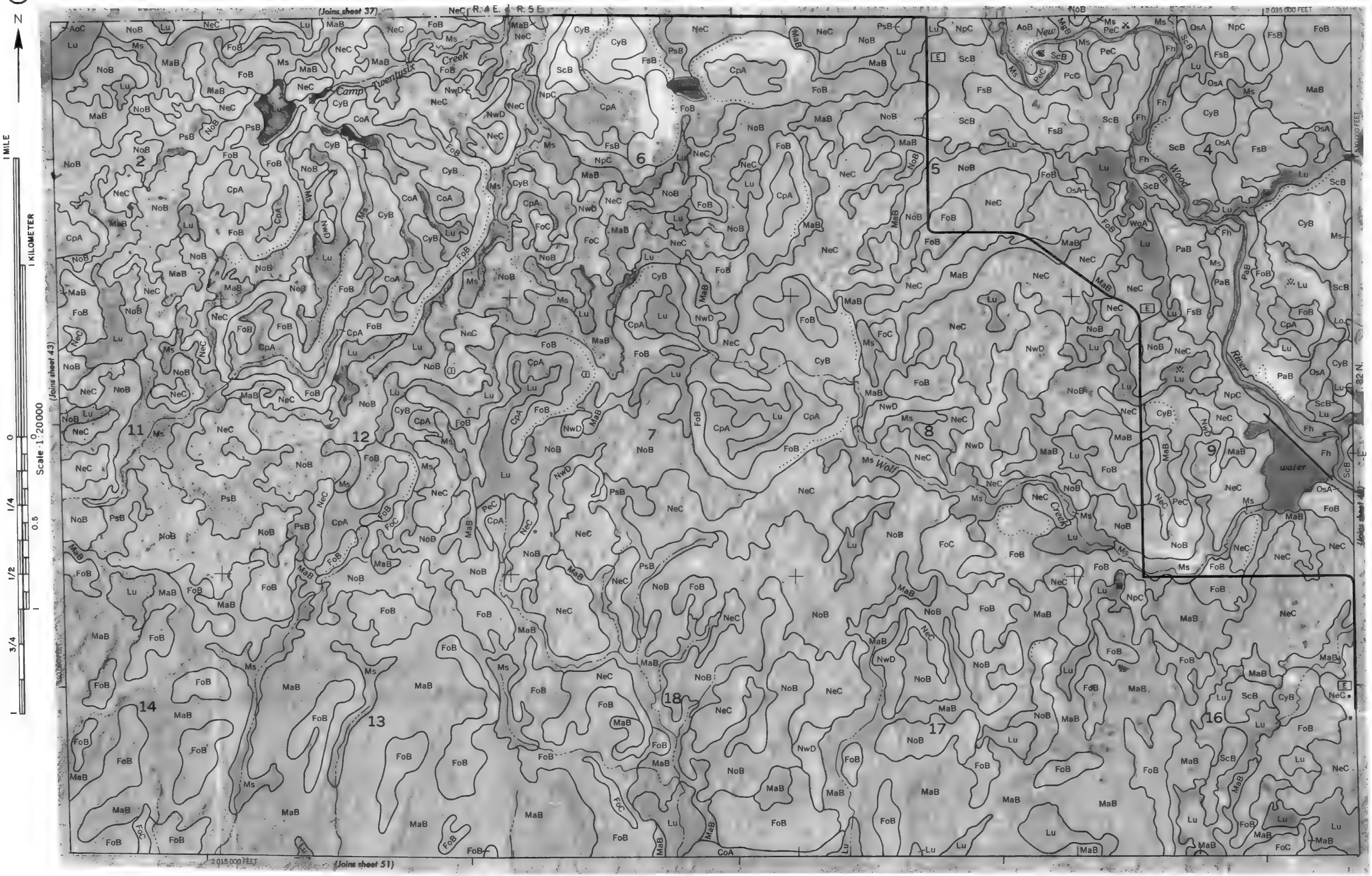
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 44



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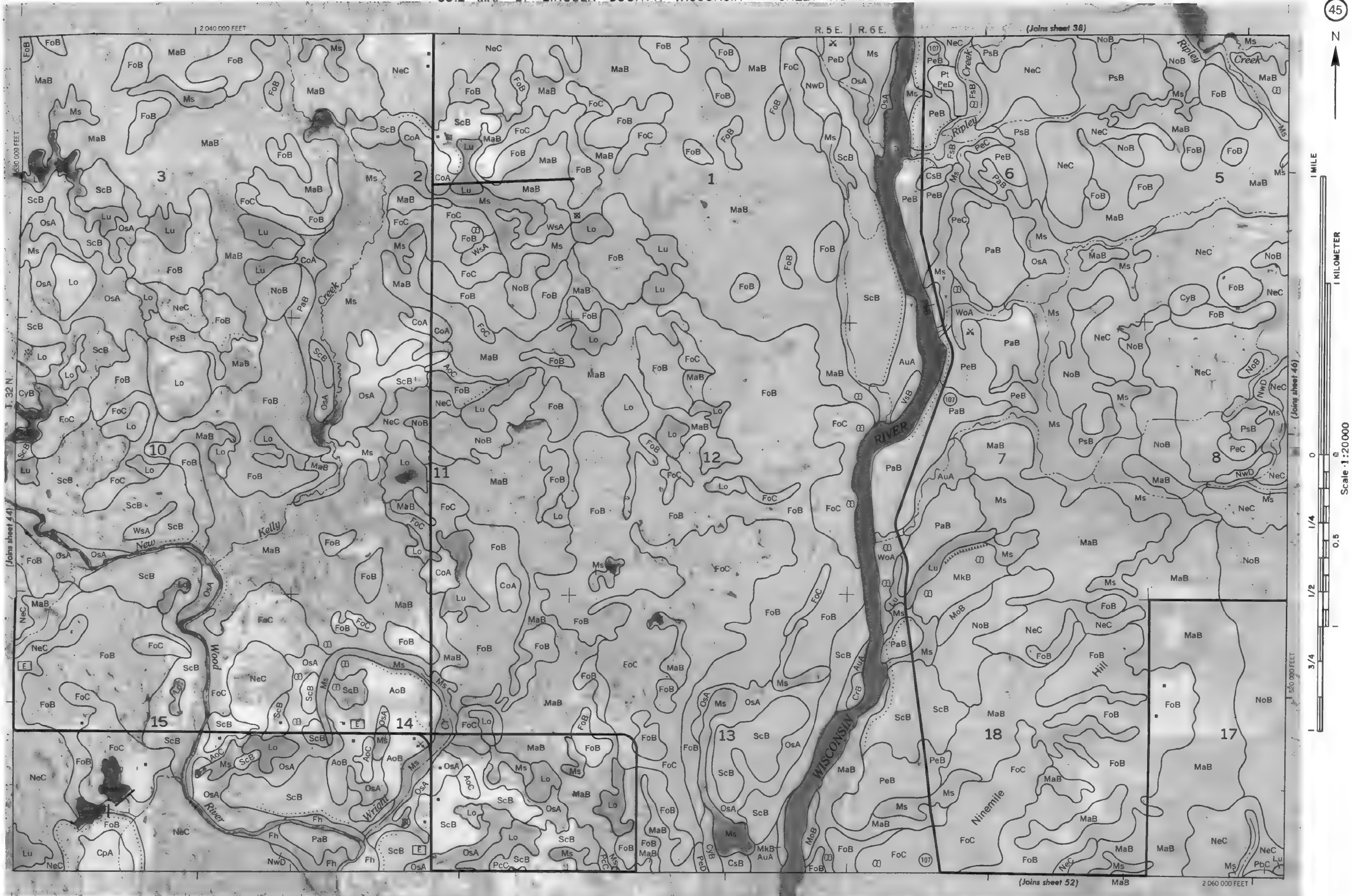
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 45



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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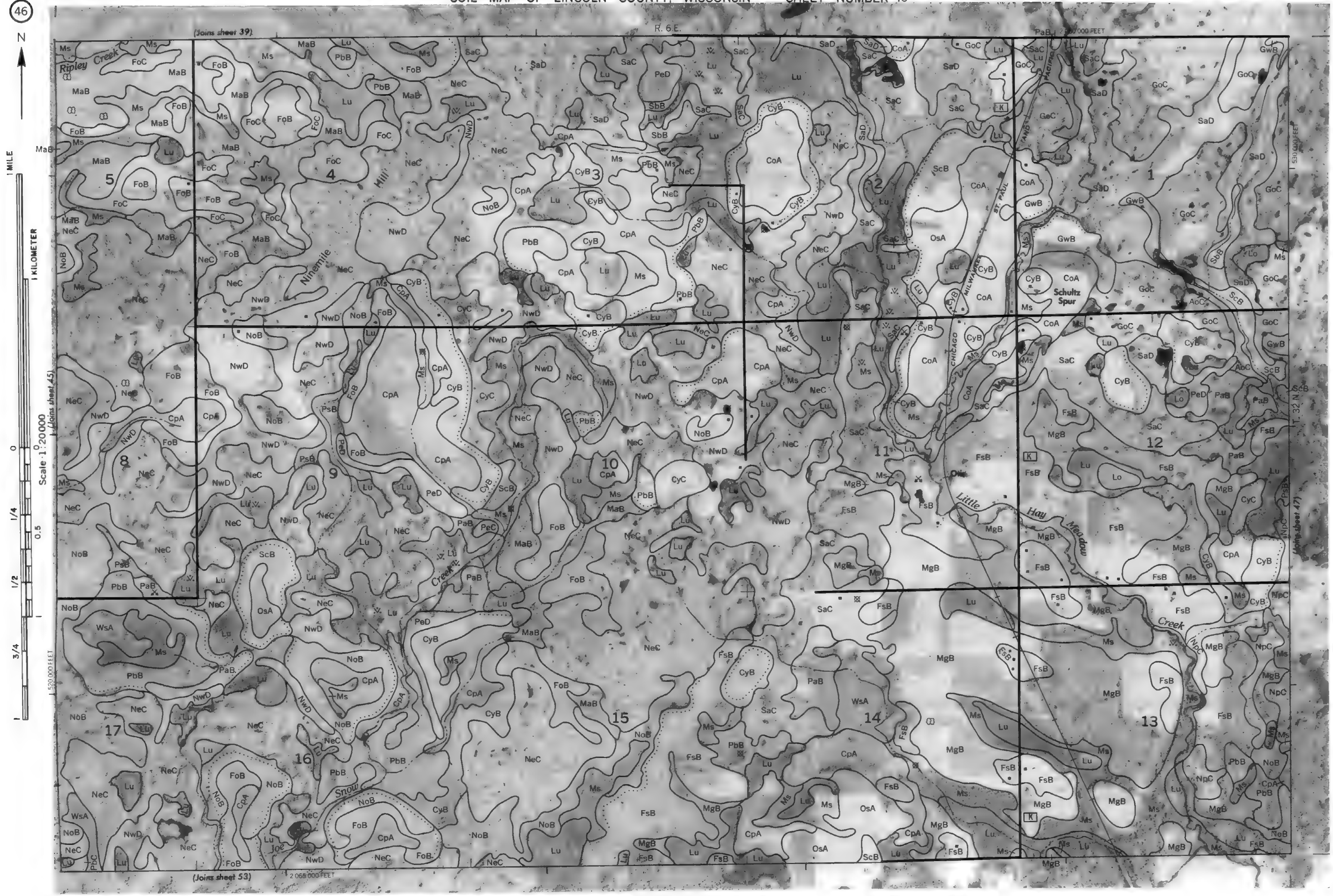
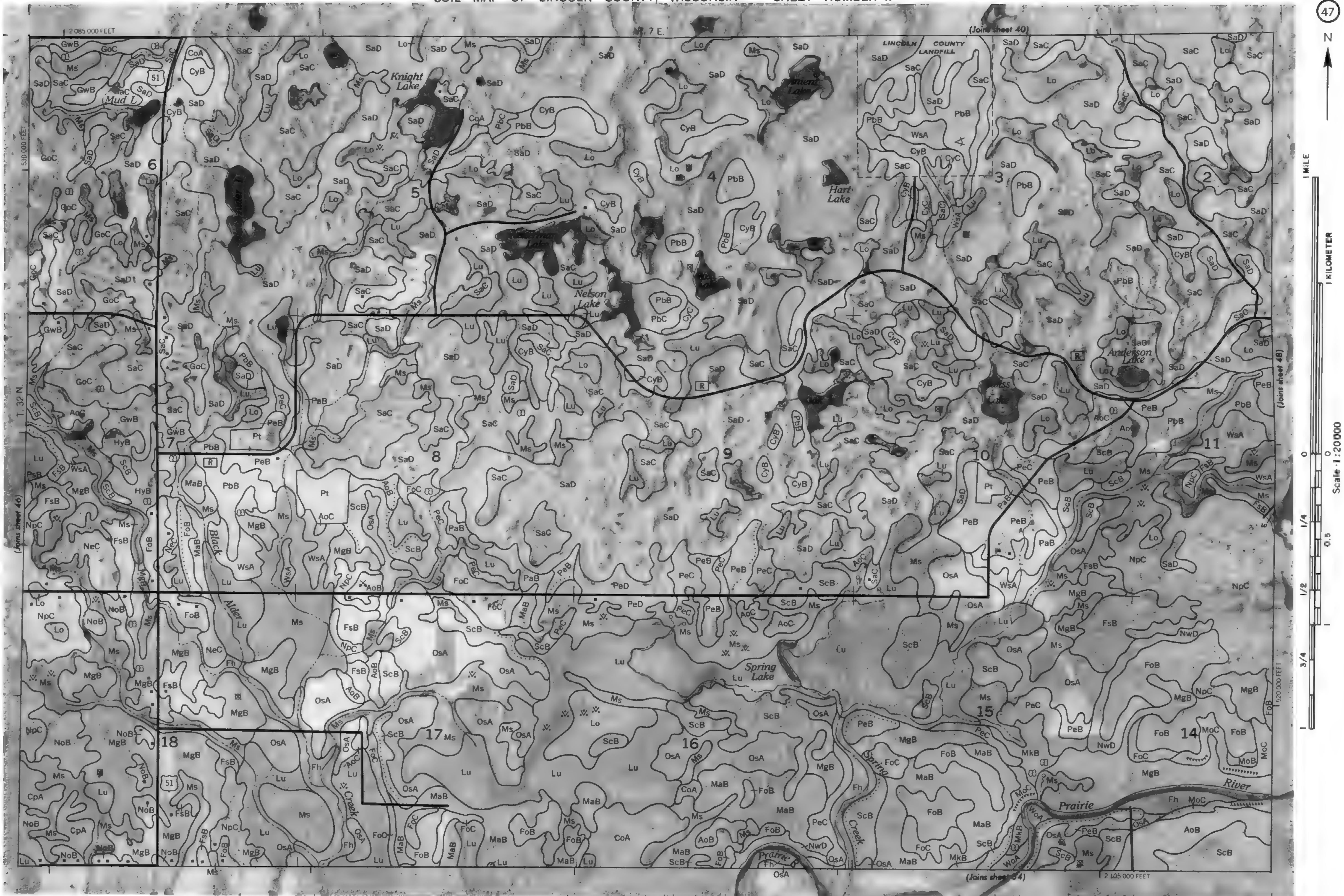
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 46



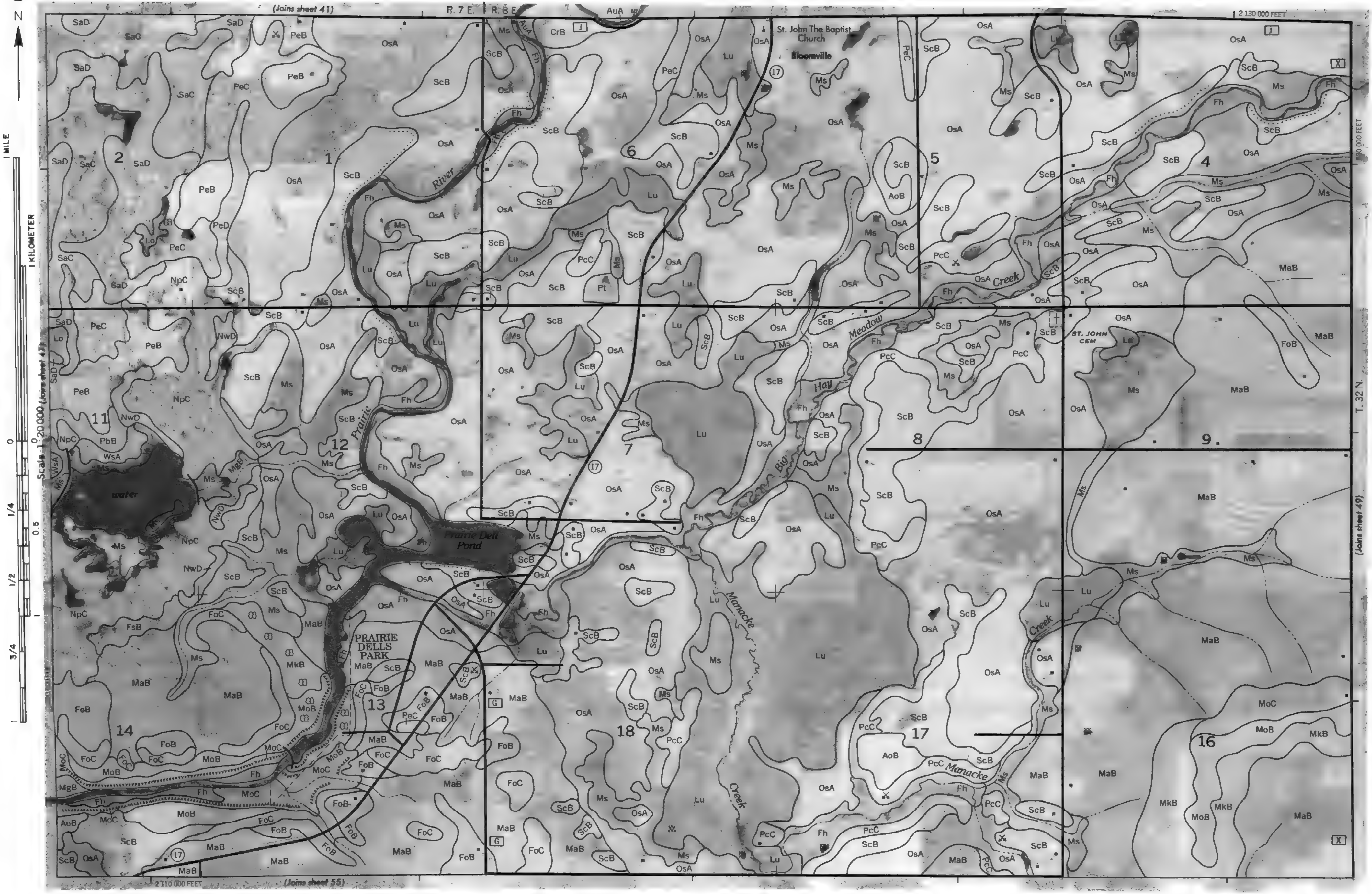
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 47



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 48



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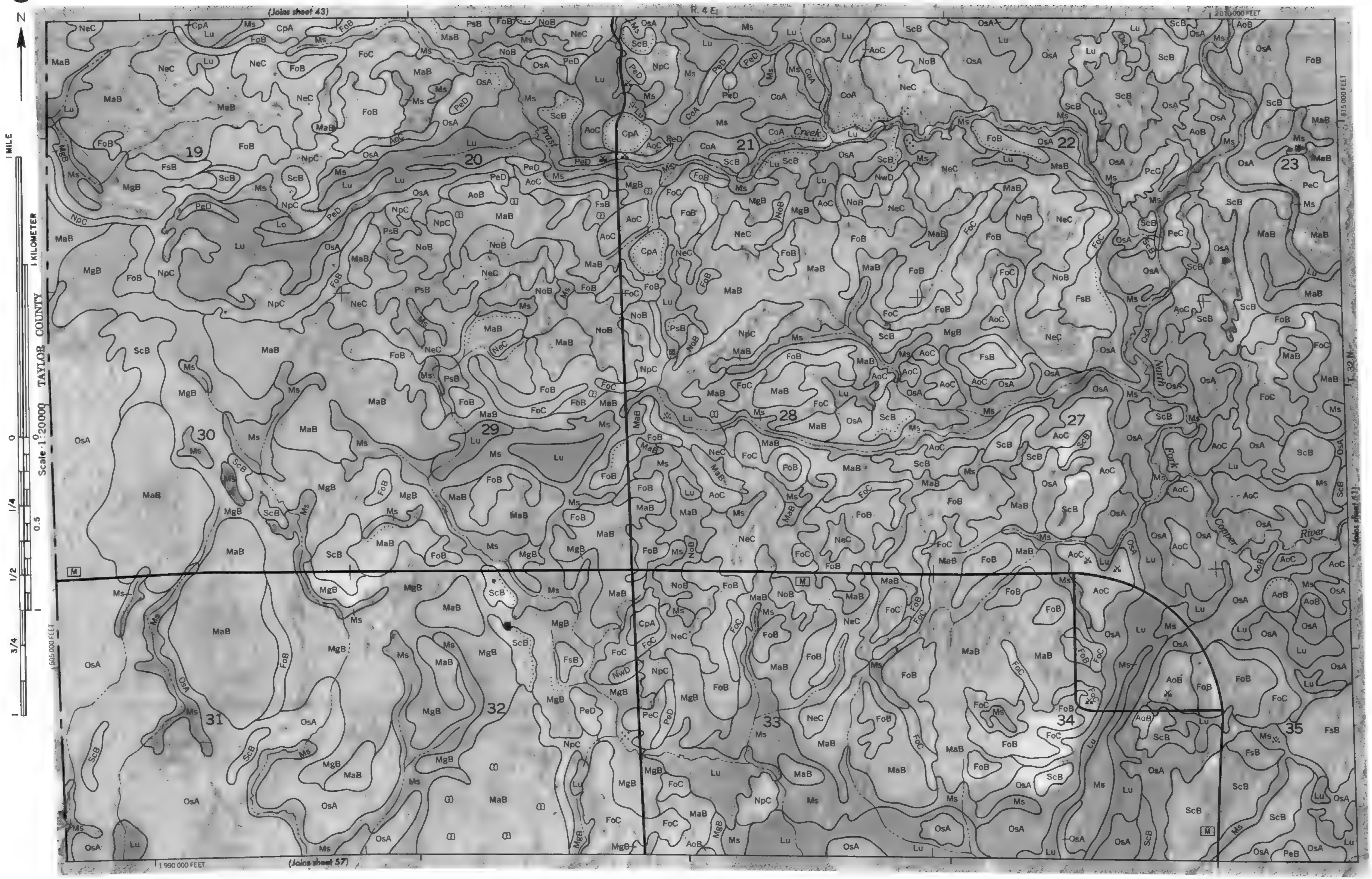
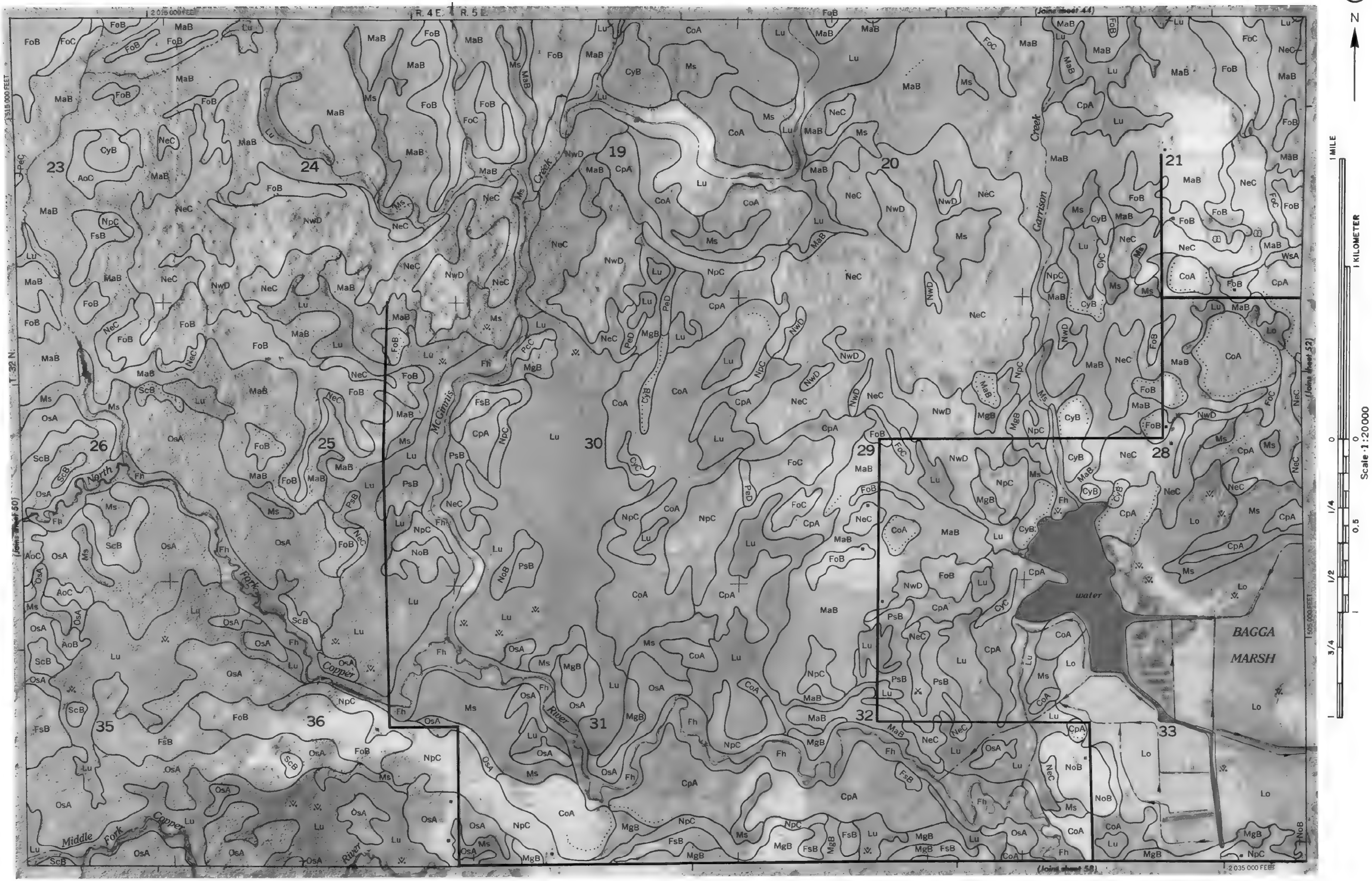
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 50

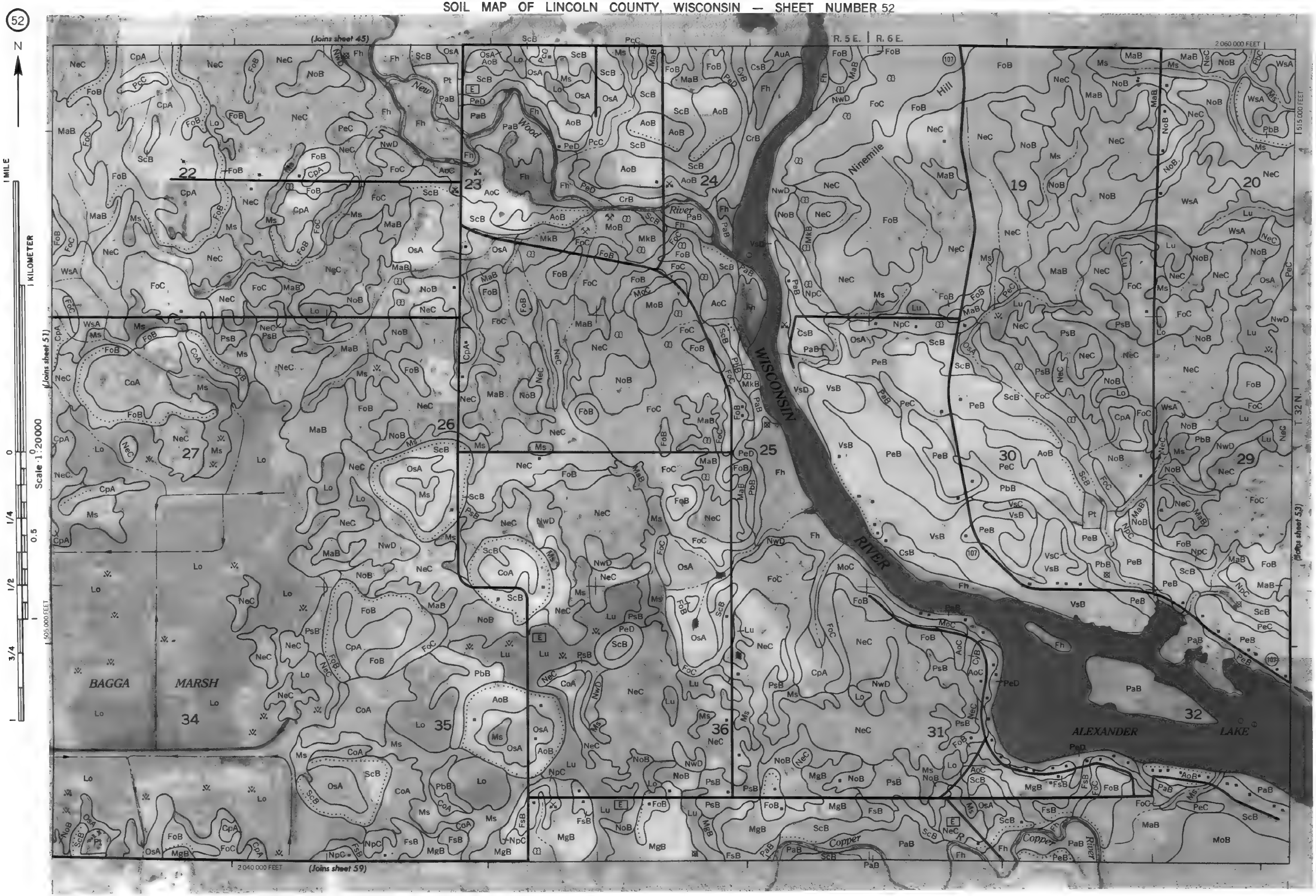


This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



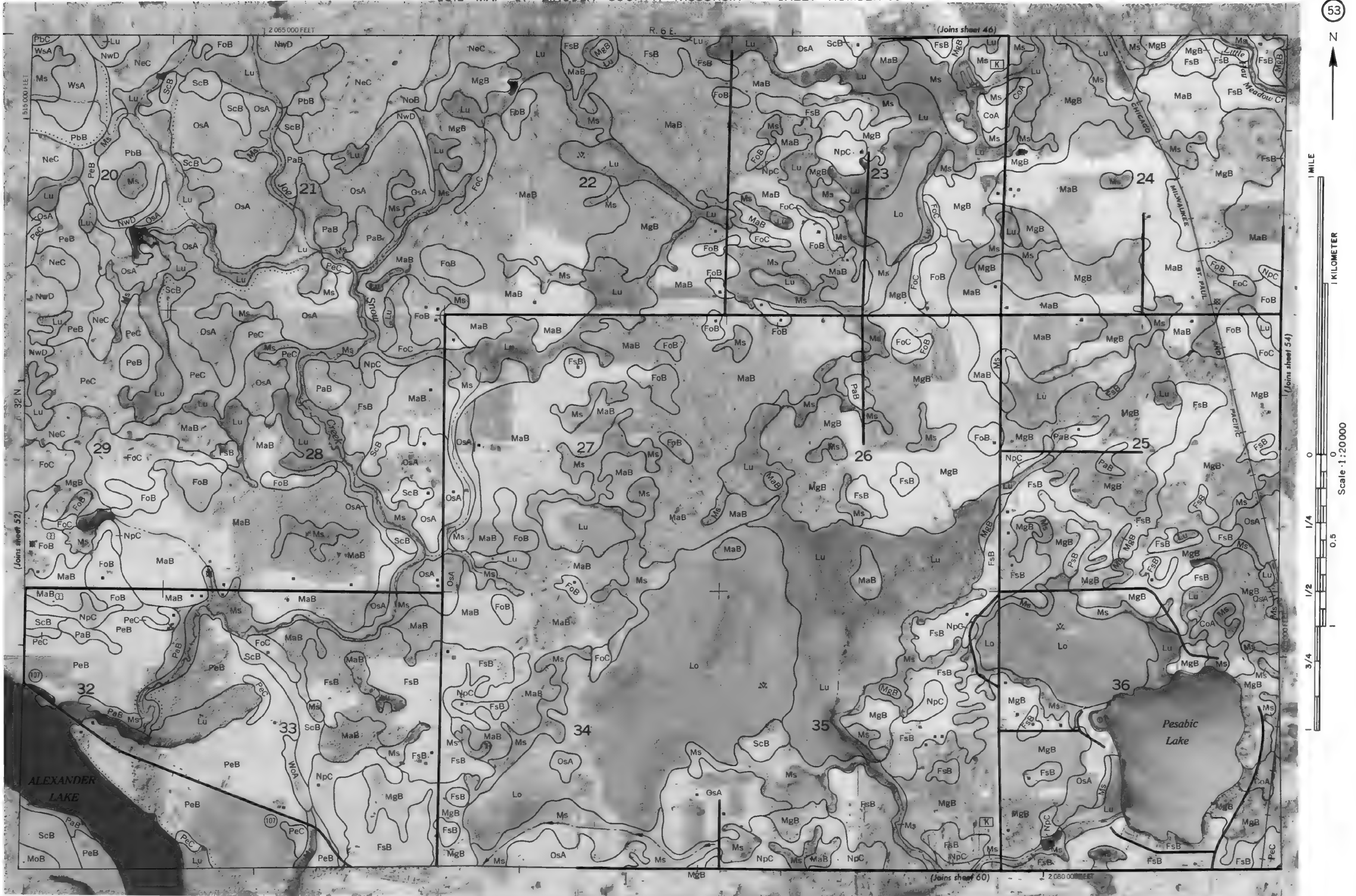
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 52



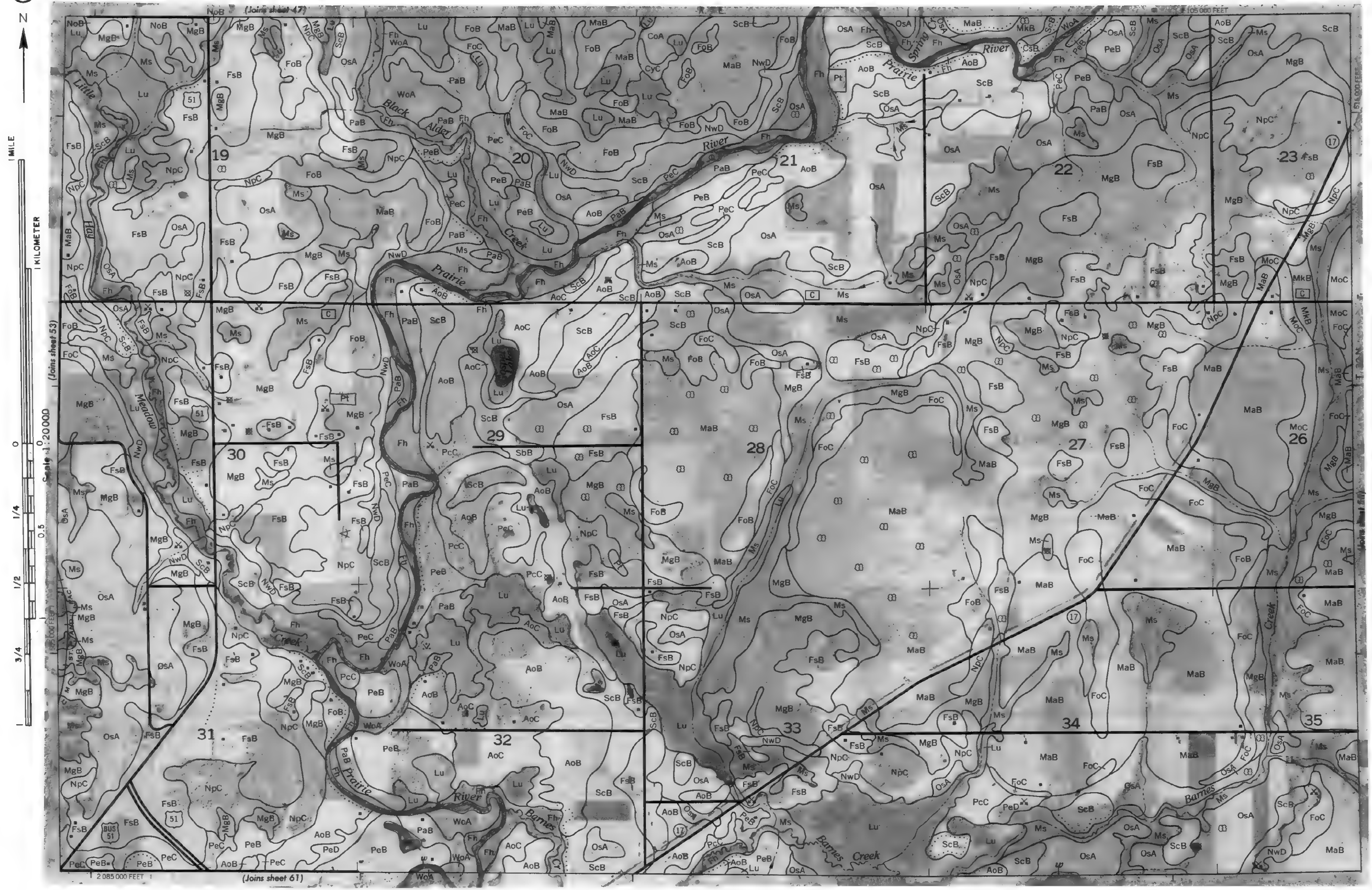
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 53



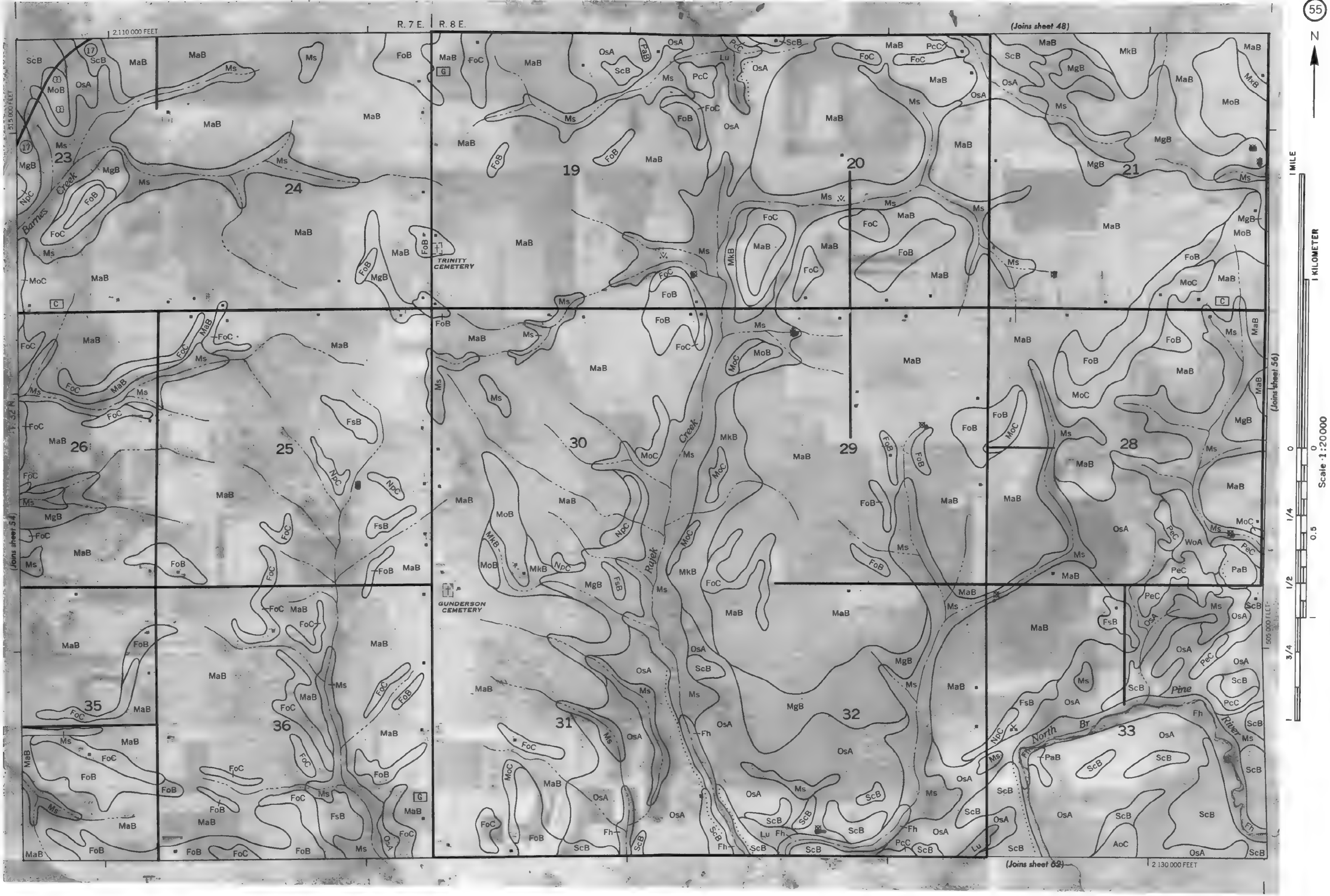
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 54



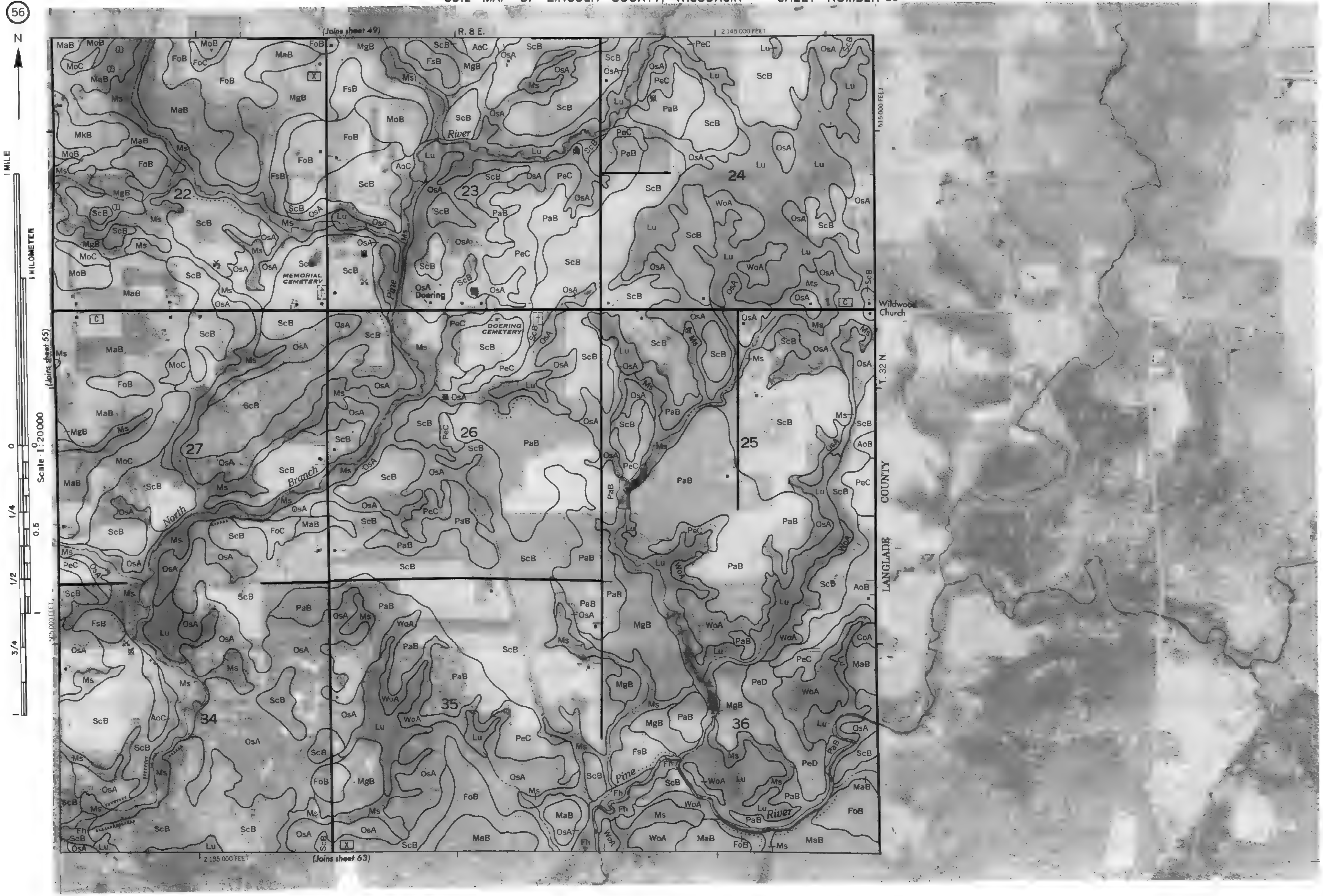
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 55



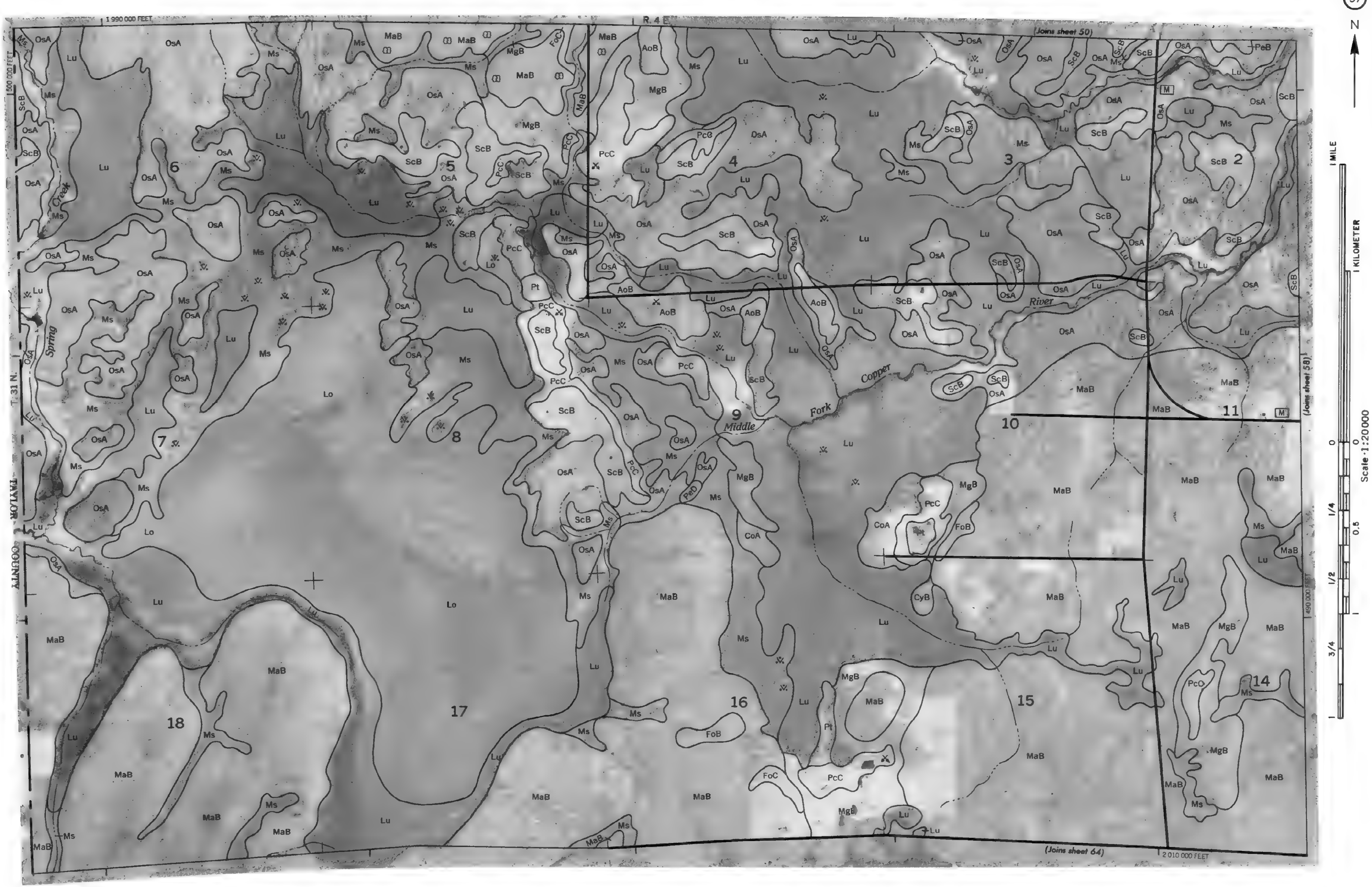
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 56



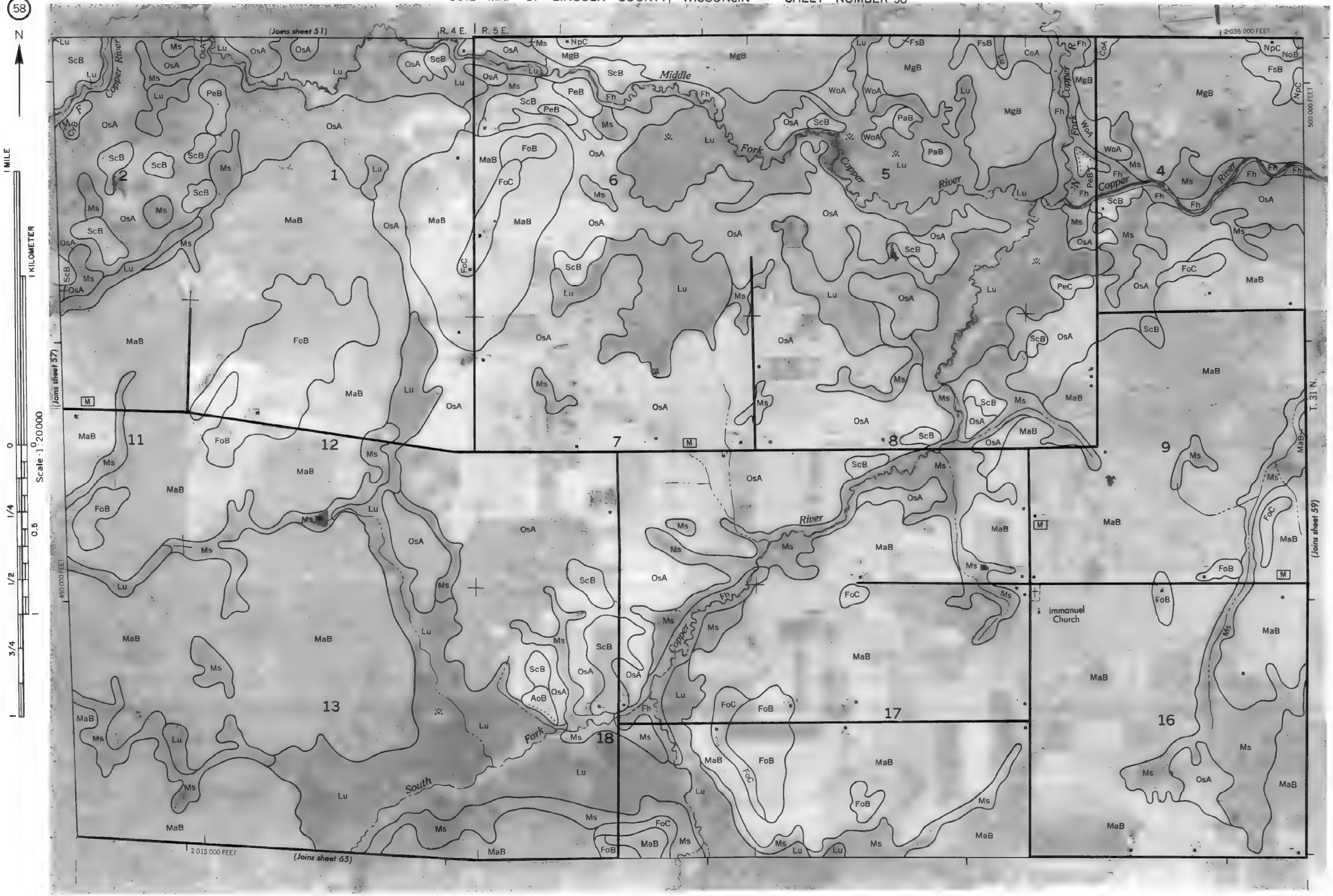
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 57



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 58



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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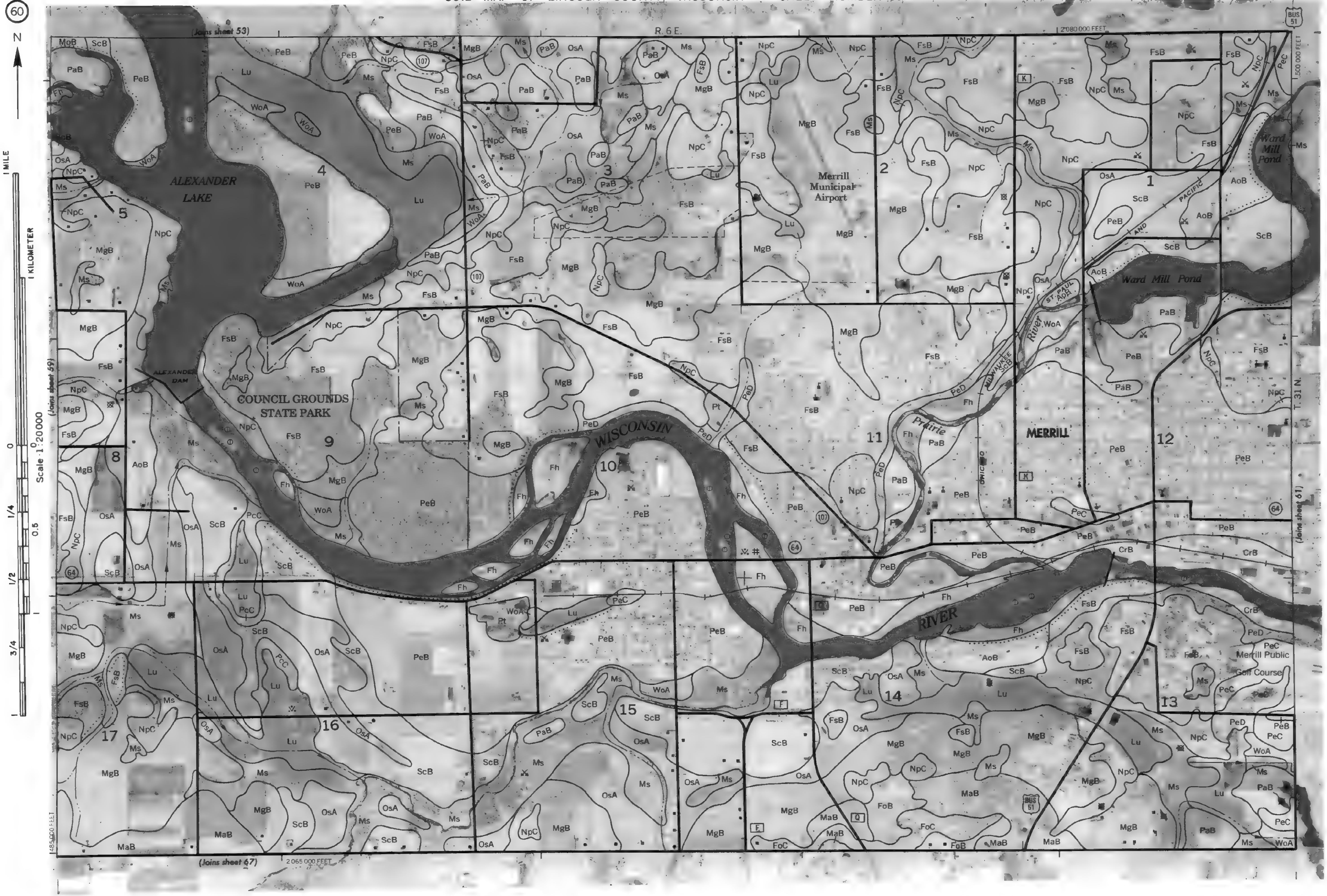
Coordinate grid ticks and land division corners if shown are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 60



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

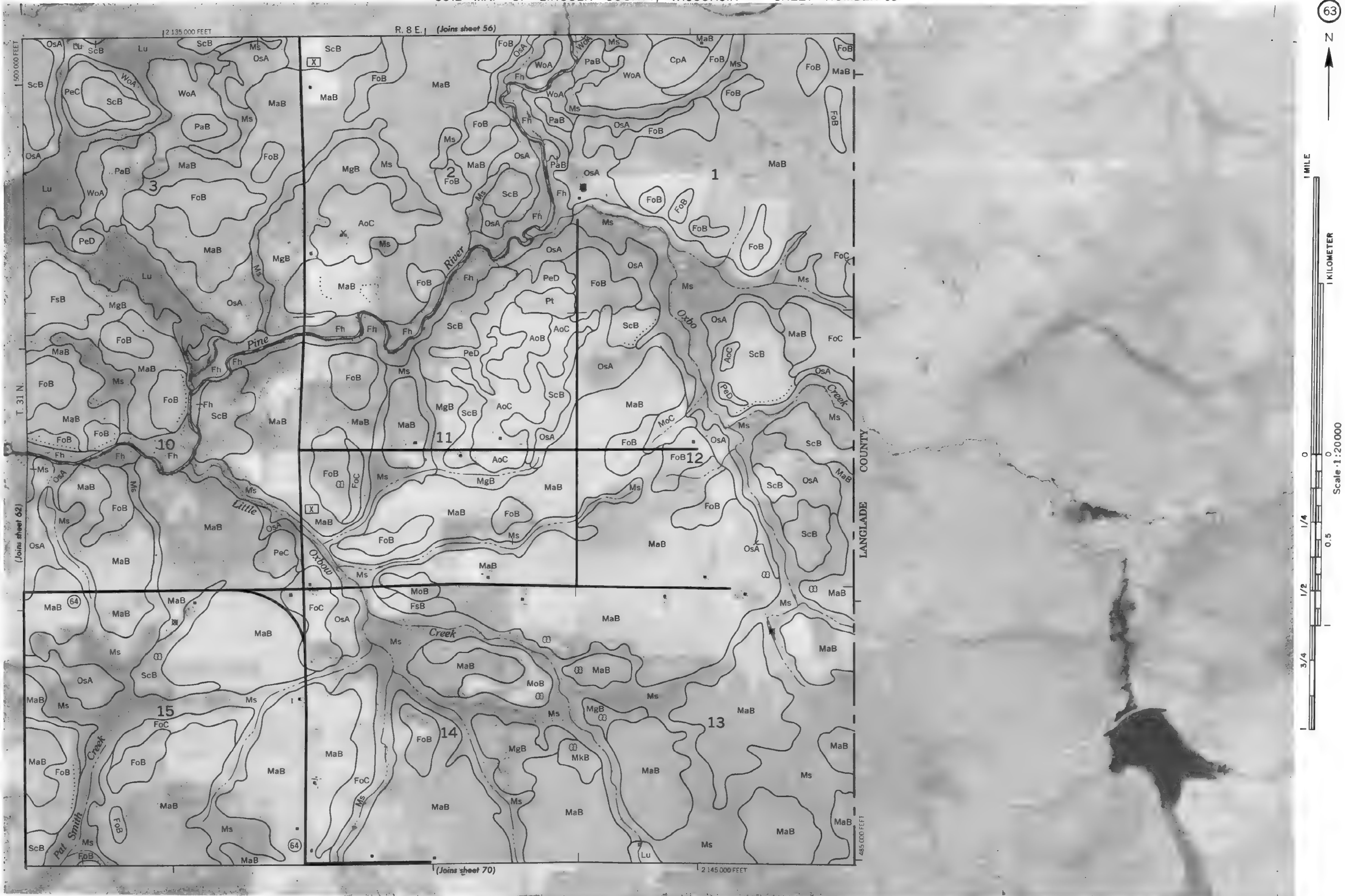
SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 61

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 62

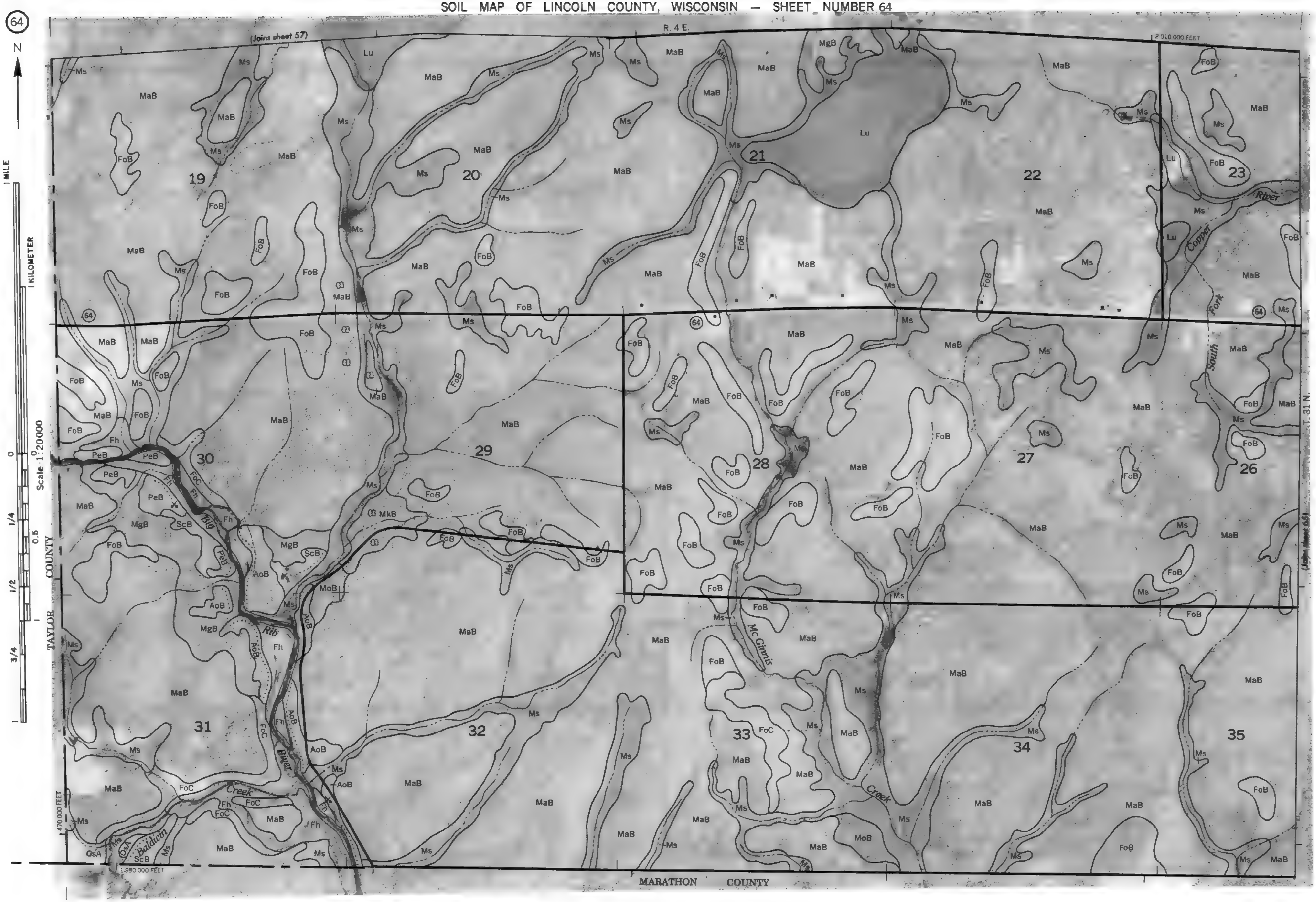
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners if shown are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 63



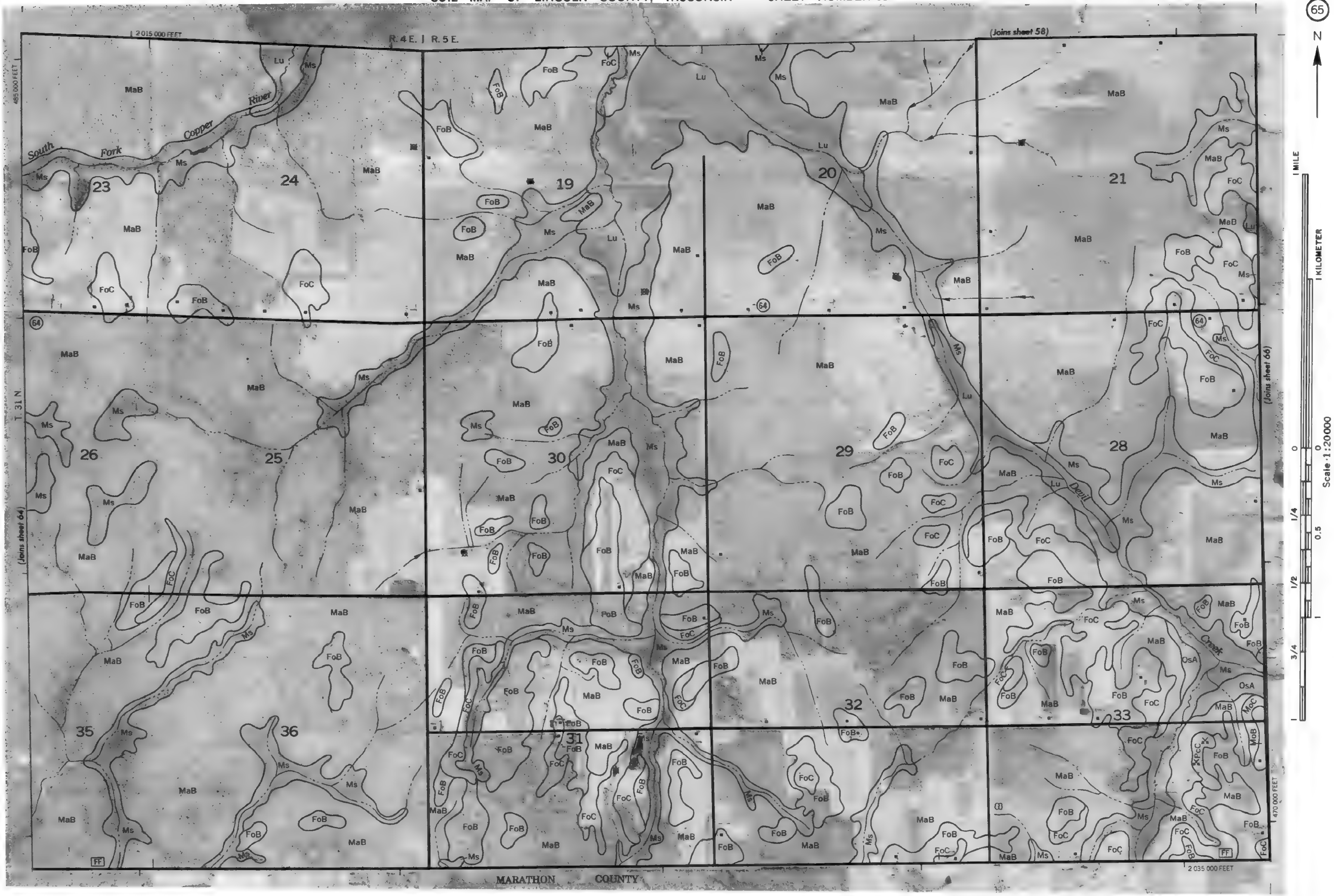
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 64



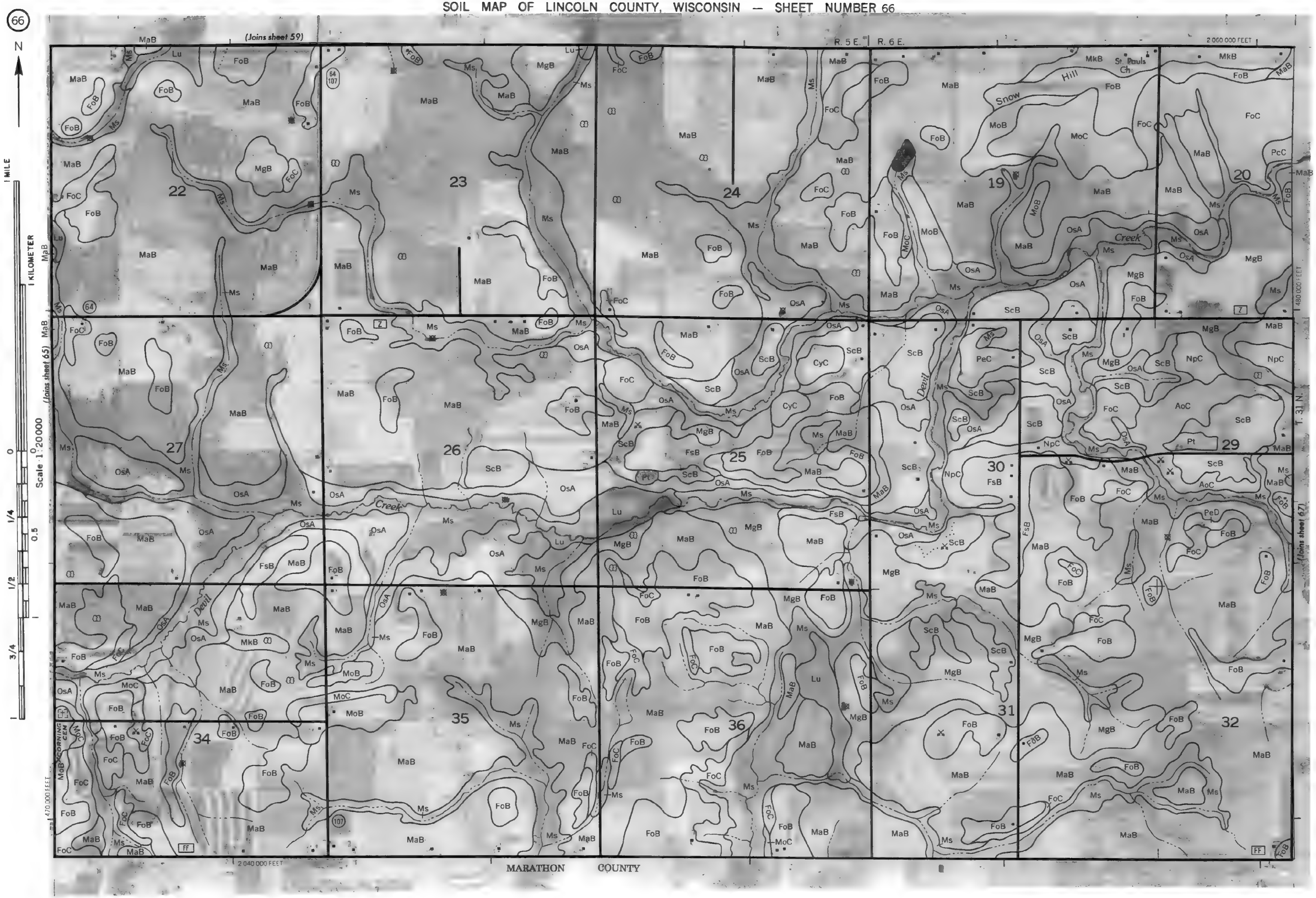
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 65



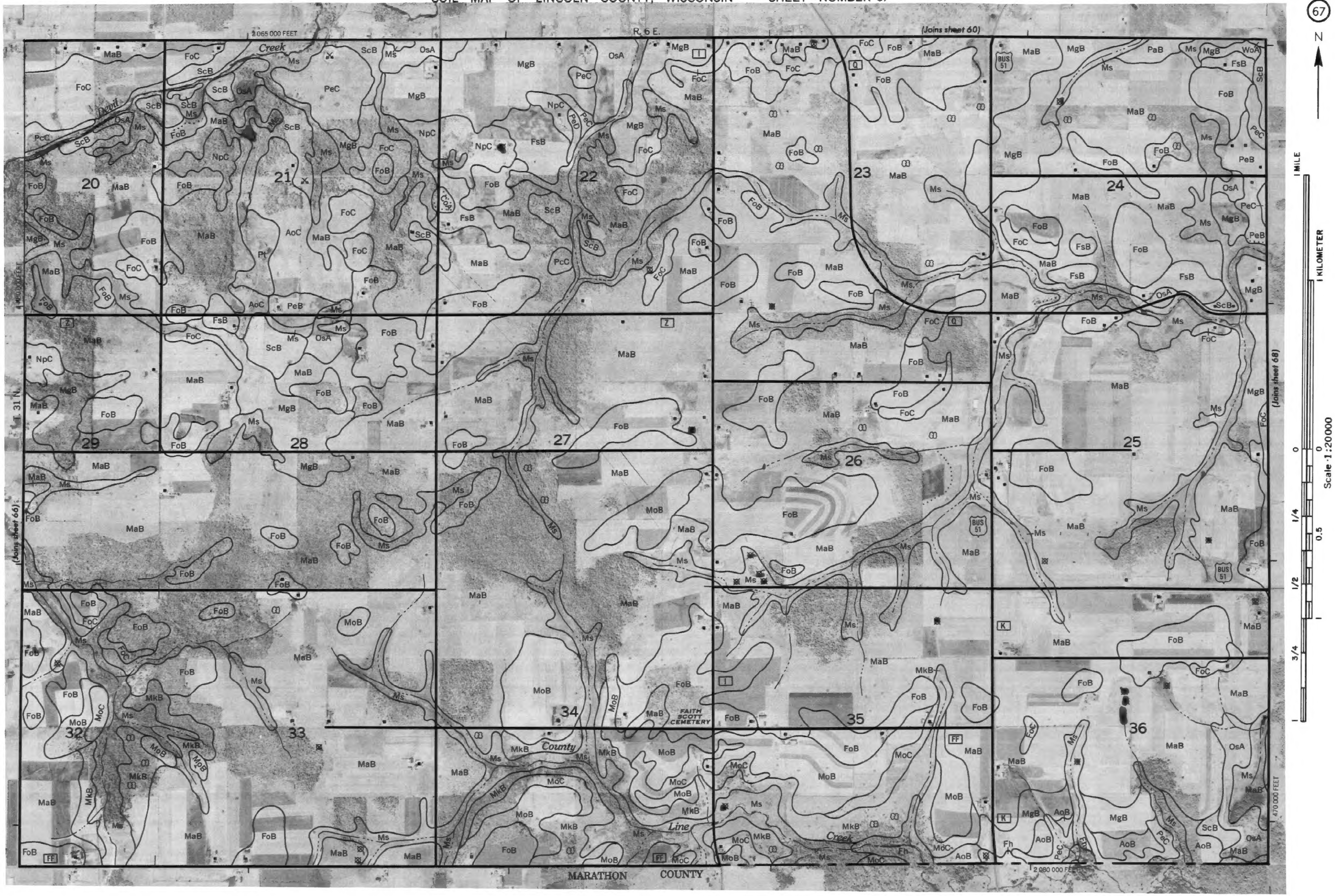
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 66



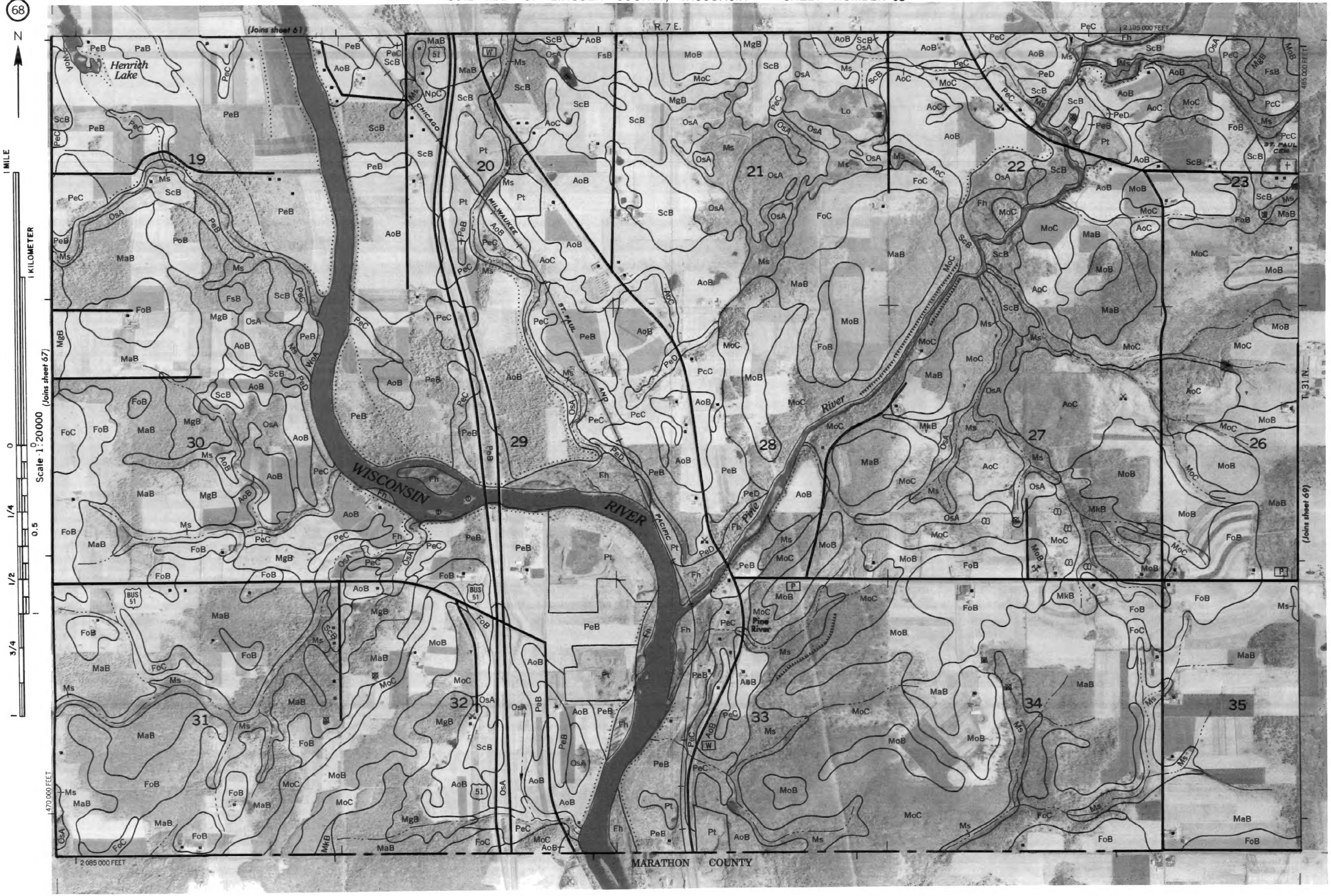
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 67



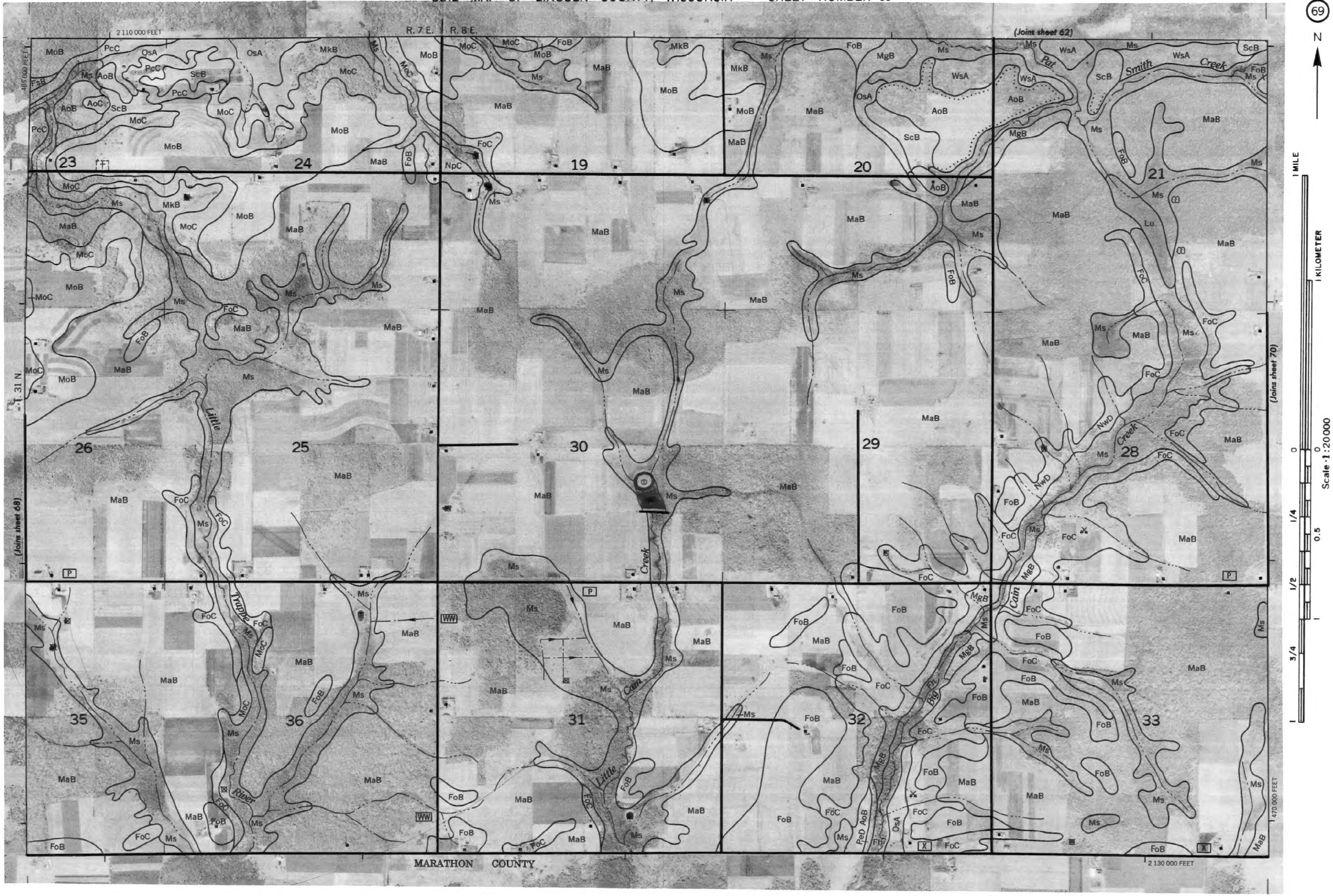
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 68



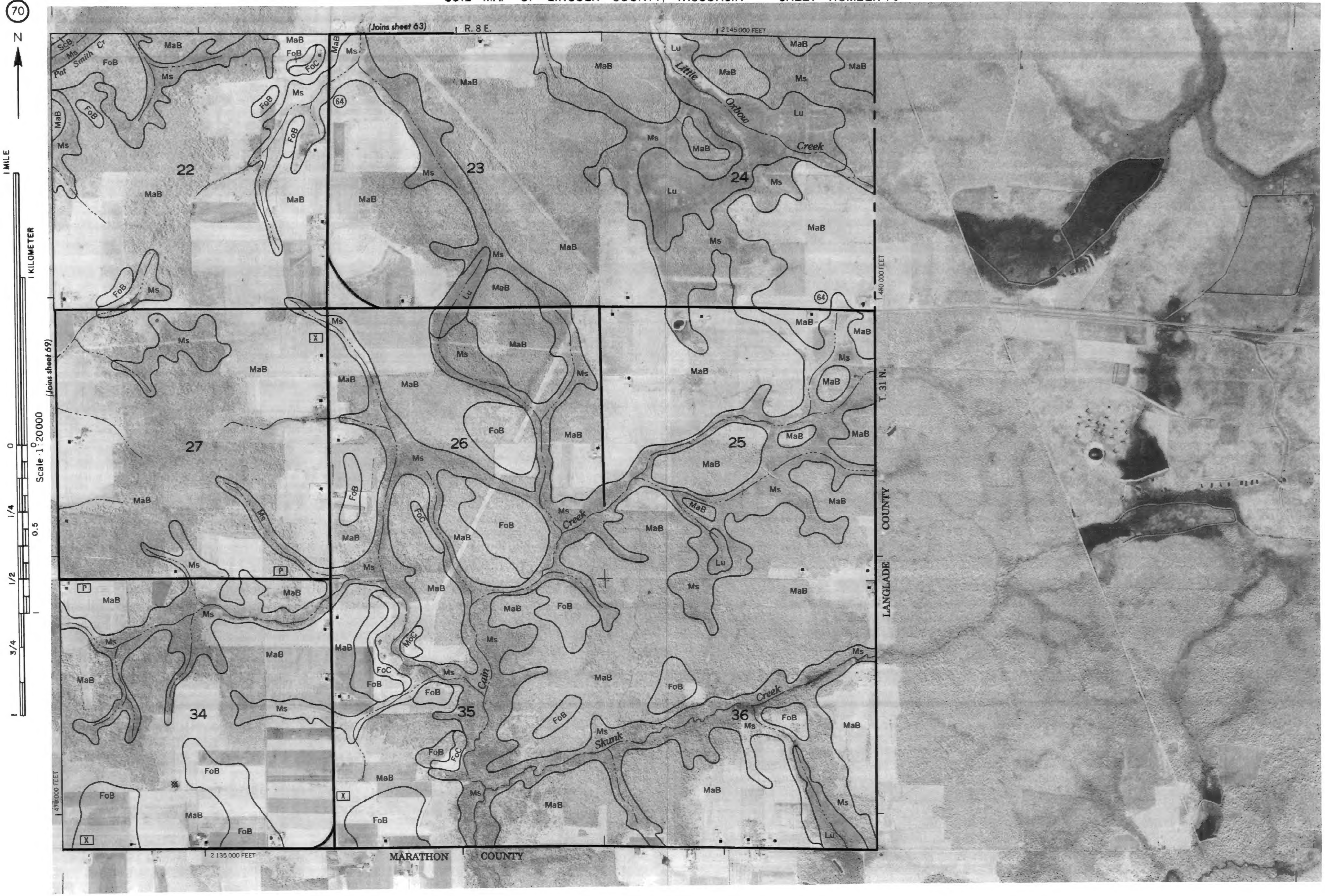
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 69



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF LINCOLN COUNTY, WISCONSIN — SHEET NUMBER 70



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.